DEN NORSKE NORDHAVS-EXPEDITION

1876—1878.

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1. ASTRONOMISKE OBSERVATIONER.

H. MOHN.

2. MAGNETISKE OBSERVATIONER.

C. WILLE.

3. GEOGRAFI OG NATURHISTORIE.

MED 6 FARVETRYKTE BILLEDER, 13 TRÆSNIT OG 2 KARTER.

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CHRISTIANIA.
GRØNDAHL & SØNS BOGTRYKKERI.
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I COMMISSION HOS H. ASCHEHOUG & C°

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General reports

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H. MOHN.

2. MAGNETICAL OBSERVATIONS.

C. WILLE.

3. GEOGRAPHY AND NATURAL HISTORY.

WITH 6 CHROMO-LITHOGRAPHS, 13 WOOD ENGRAVINGS AND 2 MAPS.

H. MOHN.

CHRISTIANIA.
PRINTED BY GRØNDAHL & SØN.
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H. Mohn. Astronomiske Observationer til Tids- og Stedsbestemmelse.

De i denne Afhandling meddelte astronomiske Observationer gjordes under Expeditionens Ophold i Havn væsentlig med det Maal for Øje at tjene til Grundlag for de Tids- og Azimuthbestemmelser, der udfordredes til de magnetiske Iagttagelser. Ved Siden deraf tilsigtedes ogsaa Bredde- og Længdebestemmelser, der kunde være af geografisk Interesse, som paa Jan Mayen og Spidsbergen. Den gunstige Lejlighed, som de gjennem Telegrafen givne Tidssignaler frembød til Verification af Længden af Punkter paa Kysten af det nordlige Norge, ønskede jeg ogsaa at benytte efter Lejligheden.

Observationerne ere Solhøjder, maalte med Sextant. Af Bestyreren for det astronomiske Observatorium i Christiania, Professor C. Fearnley, fik jeg udlaant en Observatoriet tilhørende Sextant af Troughton, med Kviksølvhorizont og Stativ, det samme Instrument, som Hansteen benyttede paa sin Rejse i Sibirien i Aarene 1828—1830. I Brugen af Instrumentet modtog jeg selv Prof. Hansteens Vejledning paa Observatoriet i 1861. Paa Sextanten aflæses ved Nonien directe 10″. Ved samtlige Observationer benyttedes den lange Kikkert med ca. 10 Ganges Forstørring. Glastaget over Kviksølvhorizonten prøvede jeg, paa Røst, ved at stille det foran Kikkerten paa en Theodolith, der var indstillet paa en god Mire (et Kirkespir): Virkningen af en prismatisk Form af Glassene var saagodtsom umerkelig, og kan neppe udgjøre et Par Sekunder.

Saagodtsom alle de her meddelte Observationer ere gjorte med dette Instrument. Under Jan Mayen observeredes fra Skibsborde ogsaa med et Par andre Sextanter.

Af Uhre havdes i 1876 ombord 3 Boxchronometre, af Kullberg, Frodsham og Mewes samt et Lommechronometer, foruden almindelige Lommeuhre, hvoraf et mig tilhørende Duplexuhr. I 1877 og 1878 havde vi foruden de nævnte Uhre et Boxchronometer af Reid og i 1878 havde

H. Mohn. Astronomical Observations for determining Time, Latitude and Longitude.

The astronomical observations set forth in this Memoir were made during our stay in certain of the harbours at which the Expedition touched, — chiefly to serve as a basis of the time and azimuth determinations required for the magnetical observations. A secondary object lay in performing, if possible, divers latitude and longitude determinations that might prove of geographical interest, as, for instance, on the islands of Jan Mayen and Spitzbergen. Moreover, of the excellent opportunity afforded by the telegraph time-signals to verify the longitude of points on the northern line of the Norway coast, I was specially desirous of taking advantage.

The observations are solar altitudes, measured with the sextant. On application to Professor C. Fearnley, Director of the Astronomical Observatory at Christiania, he kindly lent me a sextant belonging to that establishment, one of Troughton's, furnished with a mercury-horizon and stand, — the identical instrument used by Hansteen on his travels in Siberia (1828—1830). In the use of the instrument Hansteen had himself given me the necessary instructions, at the Observatory, in 1861. The vernier reads 10 seconds. For all the observations, the long telescope, magnifying about 10 diameters, was exclusively used. The glass covering the mercury-horizon I tested at Røst, by placing it in front of the telescope of a theodolite directed to a good mark (a church steeple). The effect resulting from a slightly prismatic form in the glasses was well-nigh inappreciable, amounting as it did to hardly a couple of seconds.

Almost all of the observations were made with this instrument, a very few only having been taken on board with other sextants, off the coast of Jan Mayen.

Of time-keepers, we had on the first cruise, in 1876, 3 box-chronometers, made respectively by Kullberg, Frodsham, and Mewes, and a pocket-chronometer, exclusive of watches, one of which — that belonging to myself — was a duplex lever. In 1877 and 1878, we had in addition a

jeg til Observationsuhr et Lommechronometer, der var prøvet paa Observatoriet i Neufchatel.

Boxchronometrene havde sin Plads ombord i et Skab i Arbeidssalonen. De bleve hver Morgen optrukne og sammenlignede indbyrdes. I 1876 tjente Kullberg som Hoveduhr og i 1877 og 1878 Reid. Kun Hoveduhret har været benyttet til Længdebestemmelserne, da det viste sig at have en meget jevnere Gang end de øvrige. Under Rejserne blev det af de daglige Sammenligninger constateret, at der ikke indtraf nogen merkelig Forrykkelse i Hoveduhrets daglige Gang.

Ved Observationer paa Land eller paa Dæk benyttedes saagodtsom uden Undtagelse et af de andre Boxchronometre eller et Lommechronometer, stundom ogsaa et almindeligt Lommeuhr. I ethvert Tilfælde blev Observationsuhret sammenlignet med Hoveduhret før og efter Observationerne.

Før Expeditionen tiltraadte sine Rejser, bleve Boxchronometrene, med Undtagelse af Reid, daglig sammenlignede med Pendeluhret paa Observatoriet i Bergen af dettes Bestyrer, Hr. Åstrand. Under Expeditionens Ophold i norske Havne blev deres Stand for Greenwich Middeltid bestemt ved de fra Observatoriet i Christiania gjennem Telegrafen givne Tidssignaler. Disse gives hver Søndag og hver Onsdag Morgen. Signalapparatet (Morse's) staar lige ved Siden af Observatoriets Normalpendel. Der gives hver Gang 3 Signaler, nemlig $8^h\,59^m\,0^s$, $9^h\,0^m\,0^s$ og $9^h\,1^m\,0^s$ Greenwich Middeltid om Søndagene og $7^h\,59^m\,0^s$, $8^h\,0^m\,0^s$ og $8^h\,1^m\,0^s$ om Onsdagene. Tidssignalet, der høres meget skarpt paa Modtagelsesstationens Morse-Apparat, bestaar i et enkelt Slag. For at skille mellem de 3 Signaler slaaes efter det første 1 Dobbeltslag, efter det andet 2 og efter det 3die Signal 3 Dobbeltslag. Signalerne sendes til alle norske Telegrafstationer.

Med Hensyn til Nøjagtigheden af de i det Følgende givne Tids-, Længde og Bredde-Bestemmelser maa jeg bemerke Følgende:

Den af Beregningerne udledede sandsynlige Fejl af en enkelt observeret Højde (paa Land med Stativ og Kviksølvhorizont) er omkring $\pm$ 5″. Der er imidlertid, som det paa sit Sted skal vises, Tegn til, at der, foruden de egentlige tilfældige Observationsfejl, optræder constante Fejl, hvis Aarsag kunne ligge i forskjellige Omstændigheder, som i Bestemmelsen af Indexfejlen, mangelfuld Justering af Instrumentet, Excentricitet m. m. Hvad Indexfejlen angaar, da er den i Regelen bestemt samtidig med Observationerne og ved gjennemsnitlig 4 Satser Dobbeltcontacter af Solranderne. Middelfejlen af Resultatet af en enkelt Sats finder jeg at være $\pm$ 5″.7 og Middelfejlen for en Bestemmelse af Indexfejlen skulde saaledes være $\pm$ 2″.85. Instrumentet holdtes altid godt justeret og om Excentricitet af nogen merkelig Virkning nævner Prof. Hansteen ikke Noget. Ved Observationerne i Hammerfest (Fuglenes) og i Bodø antydes imidlertid Tilstedeværelsen af constante Feil i Højden af respektive +8″ og —8″. En Del heraf kunde

box-chronometer by Reid, and in the latter year I took observations with a pocket-chronometer, tested at the Observatory of Neufchatel.

The box-chronometers were kept in a cupboard in the work-room. They were wound up every morning and duly compared. In 1876, Kullberg's served as chief time-keeper, in 1867 and 1878 that by Reid. For determinations of longitude, exclusive use was made of the chief time-keeper, its rate having proved much more uniform than that of the other chronometers. On each cruise the result of the daily comparison showed that no appreciable disturbance had occurred in the diurnal rate of the chief time-keeper.

For observations on shore, or from the deck of the vessel, we used almost without exception one of the other box-chronometers, or a pocket-chronometer, nay sometimes a watch. The chronometer or watch, whichever it might be, was, however, invariably compared with the chief time-keeper both before and after the observations.

Previous to the departure of the Expedition on its several cruises, the box-chronometers, with the exception of Reid's, were daily compared with the standard-clock of the Bergen Observatory, by the Director, Mr. Åstrand. During the stay of the Expedition at Norwegian ports, their error on Greenwich mean time was determined by the time-signals telegraphed from the Observatory at Christiania. These signals are sent every Sunday and Wednesday morning. The signalling apparatus (Morse's) stands close beside the standard-clock of the Observatory. Three signals are given, viz. at $8^h\,59^m\,0^s$, $9^h\,0^m\,0^s$, and $9^h\,1^m\,0^s$, Greenwich mean time, on Sundays, and at $7^h\,59^m\,0^s$, $8^h\,0^m\,0^s$ and $8^h\,1^m\,0^s$ on Wednesdays. Each signal, distinctly delivered by the apparatus of the receiving-station, consists of a single click. As a means of readily distinguishing between the 3 signals, the first is followed by a double-click, the second by 2 double-clicks, and the third by 3. These signals are transmitted to all Norwegian telegraph-stations.

As regards the accuracy of the observations for determining time, latitude, and longitude, I must observe as follows: —

The computed probable error of a single observed altitude (using on shore the sextant with a stand and mercury-horizon) is about $\pm$ 5″. Meanwhile, there is reason to believe, as will afterwards appear, that, apart from the accidental errors of observation, certain constant errors occur, arising probably from various sources, such as the determination of the index-error, imperfect adjustment of the instrument, excentricity, &c. With regard to the index-error, this has usually been determined when taking the observations, and on an average from 4 sets of double contacts of the solar limbs. The mean error of the result of one double contact I found to be $\pm$ 5″.7, and the mean error of the determination of the index-error should accordingly have been $\pm$ 2″.85. The instrument was always kept well adjusted, and of excentricity that could have any appreciable effect, Hansteen says nothing whatever. Meanwhile, the observations taken at Hammerfest (Fuglenes) and at Bodö indicate the existence of constant errors in the

muligens tilskrives Ujevnhed i Chronometrets Gang, men saameget bliver tilbage som Fejl i Højderne, at jeg anser det rigtigst at antage, at mine Højder, med et rundt Tal, kunne være beheftede med en sandsynlig constant Fejl for hver Station af $\pm$ 10″.

Paa den Nøjagtighed, hvormed Observationsuhret angiver Greenwich Middeltid, har jeg søgt at faa et Maal ved følgende Overslag:

Observationsuhrets Sammenligning med Hoveduhret. Der toges flere Sammenligninger før og efter Højdeobservationerne. Af disse finder jeg for 1877, mit Duplexuhr, en sandsynlig Fejl af den anvendte Uhrforskjel af $\pm 0.^{s}15$ (efter 4 Sammenligninger) og $\pm 0.^{s}11$ af 4 Sammenligninger før og 4 efter Observationerne. For 1878 finder jeg for Sammenligningen mellem mit Lommechronometer og Chronometer Reid saavel i Søen som i Havn, Middelfejlen af en enkelt Sammenligning $\pm 0.^{s}10$. I Regelen gjordes 3 Sammenligninger, saaat Middelfejlen ved en Sammenligning før eller efter Højdeobservationerne kan sættes til $\pm 0.^{s}06$ og af Mediet af begge til $\pm 0.^{s}04$. Jeg kalder i det følgende denne sandsynlige Fejl D_1 og sætter med et rundt Tal $D_1 = \pm 0.^{s}1$.

Naar Tidssignal skulde observeres, var Regelen den, at Skibschefen, Capt. Wille, først sammenlignede Observationsuhret, et Lommechronometer, der slog $0.^{s}4$, med Hovedchronometret, derpaa gik i Land paa Telegrafkontoret og efter Tilhagekomsten ombord atter tog en Uhrsammenligning. Jeg antager, efter et Skjøn, denne Operations Resultat at have en sandsynlig Fejl af $\pm 0.^{s}1$, som jeg kalder D_2.

Paa Telegrafkontoret observerede Capt. Wille Tidssignalerne efter Observationsuhret. Den sandsynlige Fejl af Observationen af et enkelt Signal antager jeg at kunne sætte til $\pm 0.^{s}2$. Da i Regelen neppe mere end 2 af de 3 Signaler kunne antages at blive godt observerede (ved de 2 sidste er man forberedt paa Secundet), sætter jeg den sandsynlige Fejl af Resultatet af Observationen af Tidssignalerne til $\pm 0.^{s}15$ (D_3). Ved en Lejlighed, da vi begge observerede Tidssignalerne, stemte vor Bestemmelse af Hovedchronometrets Stand paa $0.^{s}1$.

Ved Signalets Afsendelse paa Observatoriet i Christiania kan den sandsynlige Fejl, efter Vidnesbyrd fra vedkommende Astronomer, sættes til $0.^{s}15$ pr. Signal, $\pm 0.^{s}10$ pr. 2 Signaler (D_4).

Ligeledes sættes den sandsynlige Fejl af Normalpendelens beregnede Stand for Christiania Stjernetid, corrigeret efter efterfølgende Tidsbestemmelse, til $\pm 0.^{s}1$ (D_5).

Den sandsynlige Fejl af den nedenfor antagne Tidsforskjel mellem Christiania og Greenwich Observatoriers Meridianer sættes til $\pm 0.^{s}2$ (D_6).

Ved Længdeberegningerne er forudsat en jevn Gang hos Hovedchronometret mellem de Tidspunkter, da dets

altitude amounting respectively to $+8''$ and $-8''$. Some part of this error may perhaps be ascribed to want of uniformity in the rate of the chronometer; but even with this deduction, the remainder is, I think, as an actual error in the altitudes, sufficient to warrant assuming that my solar altitudes may be affected by a probable constant error at each Station of $\pm$ 10″.

Of the precision with which the chronometer used for noting the observations indicates Greenwich mean time, I have sought to find a measure as follows: —

Comparison of the watch or chronometer selected for the observation with the chief time-keeper. Several comparisons were made before and after the observations of altitude. Now, for 1877 (my duplex watch), I find a probable error of the assumed difference of the errors of the time-pieces (4 comparisons) of $\pm 0.^{s}15$, and with 4 comparisons before and 4 after the observations, of $\pm 0.^{s}11$. For 1878, I find the mean error of a single comparison between my pocket-chronometer and the box-chronometer by Reid, both at sea and in harbour, to have been $\pm 0.^{s}10$. The number of comparisons having as a rule been three, the mean error of one comparison before or one after a series of altitudes may be put at $\pm 0.^{s}06$, and the mean error of two comparisons, one before and one after, at $\pm 0.^{s}04$. In the sequel I shall call this probable error D_1, and assume $D_1 = \pm 0.^{s}1$.

The time-signals were generally observed as follows: — Shortly before their arrival, the commander of the vessel, Capt. Wille, compared a pocket-chronometer, beating $0.^{s}4$, with our chief time-keeper. He then went on shore to the telegraph-office, observed the signals, and, on his return to the ship, again compared the respective time-pieces. The probable error of these comparisons on board may, I think, be estimated at $\pm 0.^{s}1$, which I shall call D_2.

At the telegraph-office Capt. Wille observed the time-signals with the pocket-chronometer mentioned above. The probable error of the observation of one signal I have put at $\pm 0.^{s}2$. Now, as only 2 of the 3 signals, on an average, will be accurately observed (for the 2 last the observer is prepared to the second), I shall estimate the probable error of the result of our observations of the time-signals at $\pm 0.^{s}15$ (D_3). On one occasion, when both of us (myself and Capt. Wille) observed the time-signals, our determination of the error of the chief chronometer agreed within $0.^{s}1$.

According to the estimate of the astronomers of the Christiania Observatory, the probable error of one signal as given with the key at the Observatory may be put at $\pm 0.^{s}15$, of two signals $\pm 0.^{s}10$ (D_4).

The probable error of the computed error of the standard clock on Christiania sidereal time, corrected from later transits of stars, is put at $\pm 0.^{s}1$ (D_5).

The probable error of the difference in time, as given below, between the meridians of the Christiania and Greenwich Observatories, is put at $\pm 0.^{s}2$ (D_6).

For computations of longitude, the chief chronometer is assumed to have had a uniform rate between the moments

Stand er bestemt ved Tidssignaler. Den sandsynlige Fejl eller Afvigelse fra den absolut jevne Gang sætter jeg, da den midlere Gang hos Chronometret Reid viser sig saa udmerket jevn, til $\pm$ 0.ˢ25 (D_7).

Den galvaniske Strøm, ved hvilken Tidssignalerne gives, gaar ikke directe gjennem alle Stationers Apparater, men sendes ved Overdrag videre fra visse Overdragsstationer. For de Stationers Vedkommende, hvorom her er Spørgsmaal, er der Overdrag i Christiania, Throndhjem, Lødingen og Kistrand. Ved Overdragene lider Signalet en Forsinkelse. Størrelsen af denne fik jeg ved Telegrafdirektør Nielsen's og Telegrafintendant Collett's Velvilje bestemt paa følgende Maade: Strømmen sendtes fra Christiania over Throndhjem til Lødingen og tilbage til Christiania ad to forskjellige Traade med 3 Overdrag paa Vejen. Det med en Nøgel givne Signal kom igjen og hørtes paa et ved Siden af Afsendelsesapparatet staaende Apparat. Naar jeg signalerede med Nøglen i Takt og Coincidents med mit Lommechronometer, hørtes det tilbagekommende Signal midt imellem de med Nøglen givne Signaler. Da mit Uhr slaar 4 Tiendedels Secunder, var Signalets Forsinkelse 0.ˢ20 for 3 Overdrag. Sættes Forsinkelsen lige stor for hvert Overdrag, bliver den 0.ˢ07 for hvert, og altsaa for 2 Overdrag 0.ˢ14, og for 4 Overdrag 0.ˢ28.

Ved Beregningen af Normalpendelens Angivelse for Signaløjeblikket er gaaet ud fra en Tidsforskjel af $0^h\ 42^m\ 54.^s5$ mellem Christiania og Greenwich. Efter den af Prof. Auwers i Geographisches Jahrbuch für 1880 givne Tabel over de vigtigste Observatoriers Bredde og Længde er den nævnte Tidsforskjel $0^h\ 42^m\ 53.^s8$. Forskjellen mellem de to Tal beror paa de nyere telegrafiske Bestemmelser af Længden af Kjøbenhavns Observatorium, med hvilket Christianias er forbundet chronometrisk. Idet jeg gaar ud fra den nyere Bestemmelse, bliver følgelig Klokkeslettet i Greenwich i Signaløjeblikket 0.ˢ7 større end oprindelig antaget.

Observator Geelmuyden har velvilligen meddelt mig de corrigerede Tidspunkter for Signalernes Afsendelse, der ere beregnede efter Tidsbestemmelser gjorte saavel før som efter Signalernes Afsendelse. Den følgende Tabel viser de efter de oven anførte Correctioner, Strømtid, Længdecorrection og senere Tidsbestemmelser, rettede Signaløjeblikke, som ere observerede under Expeditionen, samt Hovedchronometrenes Stand og Gang.

at which its error was found by the time-signals. The probable error or deviation from a uniform rate, I shall put — the mean rate of the Reid chronometer having proved so remarkably uniform — at $\pm$ 0.ˢ25 (D_7).

The galvanic current by which the time-signals are transmitted, does not reach every station direct, being sent on by relays from certain stations selected for that purpose. As regards the stations at which the time-signals were observed on the Expedition, the relay-stations were at Christiania, Throndhjem, Lödingen, and Kistrand. These breaks occasion some loss of time in transmitting the signal. The approximate extent of the delay I was enabled by the kindness of Mr. Nielsen, Director of Telegraphs, and of Mr. Collett, Electrician, to determine as follows: — The galvanic current was transmitted from Christiania, viâ Throndhjem, to Lödingen, and thence back to Christiania, by two different wires, and broken by three relays. The signal, given with a key, came back, being distinctly delivered from another apparatus, also standing beside the observer. When signalling with the key, its clicks coinciding with the beats of my pocket-chronometer, the returning signal would be heard at the mid-point of the interval between two successive signals given with the key. Now, as my pocket-chronometer beats four-tenths of a second, the delay in transmitting a signal must have been 0.ˢ20 with three relays; hence, with one relay, assuming it equal for each, the delay will be 0.ˢ07, with two relays 0.ˢ14, and with four 0.ˢ28.

In computing the indication of the standard-clock for the moment of the despatch of a signal, the difference in time between Christiania and Greenwich has been put at $0^h\ 42^m\ 54.^s5$. According to the Table furnished by Professor Auwers in Geographisches Jahrbuch for 1880, showing the latitude and longitunde of the chief Observatories, the difference is $0^h\ 42^m\ 53.^s8$. The want of agrement in the respective figures must be ascribed to the late telegraphic determination of the longitude of the Copenhagen Observatory, with which that at Christiania is chronometrically connected. Taking the latter of the two determinations, the assumed Greenwich time at the moment of despatch will require a correction of + 0.ˢ7.

Mr. Geelmuyden, of the Christiania Observatory, has kindly furnished me with the corrected moments for the despatch of the signals, computed from transists observed alike before and after transmission. In the following Table will be found the moments of despatch for the signals observed on the Expedition, corrected for the above-specified errors, viz. the propagation of the current, correction of assumed longitude, and subsequent determinations of clock error — as also the error and rate of the chief chronometers.

Sted. (Place.)	Datum. (Date.)	Greenwich Middeltid. (Greenwich Mean Time) a. m.	Hovedchronometer Corr. til G. M. T. (Standard Chronometer. Corr. to G. M. T.)	Daglig Gang. (Daily Rate.)
Christiansund .	1876 Juni *(June)* 25	9ʰ 0ᵐ 0.ˢ0	— 0ʰ 38ᵐ 59.ˢ6	0.ˢ59
Namsos . . .	„ Aug. *(Aug.)* 20	9 0 0.8	— 0 39 32.8	
Bergen . . .	1877 Maj *(May)* 23	8 0 0.7	+ 0 7 23.7	
Bodø	„ Juni *(June)* 24	9 0 0.9	7 54.9	0.97
Tromsø . . .	„ Juli *(July)* 11	8 0 0.9	8 10.9	0.94
Tromsø . . .	„ Juli *(July)* 22	8 59 59.3	8 20.5	0.87
Bodø	„ Aug. *(Aug.)* 12	9 0 1.3	8 40.8	0.97
Hammerfest . .	1878 Juni *(June)* 23	9 0 1.0	+ 0 15 5.5	
Hammerfest . .	„ Juli *(July)* 10	8 0 1.2	0 15 20.2	0.87
Hammerfest . .	„ Juli *(July)* 28	9 0 1.0	0 15 37.5	0.96
Tromsø . . .	„ Aug. *(Aug.)* 28	8 0 0.8	0 16 7.6	0.97

I. Husø.

En liden Ø ved Sognefjordens Munding. Sterk Nordenvind. Observationerne gjordes i Læ af Hr. Lexaus Hus. Efter Kystkartet er Bredden $\varphi = 60^\circ\ 59.'6$, Længden $\lambda = 4^\circ\ 37' = 18^m\ 28^s$ E. Greenwich $= 2^m\ 41^s$ W. Bergen. Corresponderende Højder. Chronometer Mewes No. 575. $2h'$ = aflæst dobbelt Højde. T_0 ucorrigeret Middag. ΔT_0 Middagscorrection, E. Tidsjevning, MT Middeltid.

I. Husø.

A small island at the mouth of the Sognefjord. Blowing hard from the north. The observations were taken to leeward of Mr. Lexau's house. On the coastal chart, the latitude, φ, is $60^\circ\ 59.'6$, the longitude, λ, $4^\circ\ 37' = 18^m\ 28^s$ E. Greenwich $= 2^m\ 41^s$ W. Bergen. Equal altitudes. Chronometer, Mewes No. 575. $2h'$ signifies Observed double altitude; T_0 Mean of all chronometer-times; ΔT_0 Equation of equal altitudes; E Equation of time; MT Mean time.

1876. Juni *(June)* **10.**

⊙ 2h′	Chron. a. m.	Chron. p. m.	T_0
89° 30′	22ʰ 6ᵐ 59.ˢ5	2ʰ 48ᵐ 34.ˢ0	0ʰ 27ᵐ 46.ˢ75
50	8 51.0	46 44.0	47.5
90 0	9 45.5	45 48.5	47.0
10	10 42.0	44 52.5	47.25
20	11 37.0	43 56.5	46.75
30	12 33.0	43 1.0	47.0
40	13 29.5	42 3.0	46.25
50	14 27.0	41 6.0	46.5
91 0	15 25.5	40 9.0	47.25
10	16 22.5	39 12.5	47 5
20	17 21.0	38 12.5	46.75
30	18 18.0	37 14.5	46.25
40	19 17.0	36 17.9	47.45
50	20 14.7	35 19.0	46.85
92 0	21 15.0	34 20.0	47.5

T_0 =	0ʰ 27ᵐ 46.ˢ97
ΔT_0 =	— 4.34
	0 27 42.63
E =	47.32
Mewes foran Husø Middeltid *(Fast on Husø M. T.)* .	0 28 29.95
Reduction t. *(to)* Bergen	2 41.
Correction t. *(Error on)* Bergen M. T.	— 0ʰ 25ᵐ 49.ˢ

Maj *(May)* 30	$2.^h55$	Corr. t. *(Error on)*	Bergen M. T.	=	$-0^h\ 24^m\ 44.^s3$
Juni *(June)* 10	0.45	— „ (— „)	— „ „	=	$-0\ \ 25\ \ 49.0$
		Daglig Acceleration *(Gaining daily)*			$5.^s93$

2. Reykjavik.

Den 1ste August 1876 toges af Capt. Wille og Lieutn. Petersen følgende corresponderende Højder paa den grønne Plæne ved Konsul Simsons Hus. $\varphi = 64^0\ 9.'0$, $\lambda = 1^h\ 27^m\ 36.^s6$ W. Gr. Chronometer Kullberg.

2. Reykjavik.

On the 1st of August, 1876, Capt. Wille and Lieut. Petersen took the following equal altitudes from the grass-plot adjoining Mr. Simson's house. $\varphi = 64^0\ 9.'0$, $\lambda = 1^h\ 27^m\ 36.^s6$ W. Gr. Kullberg's chronometer.

⊙ 2h′	Chron. a. m.	Chron. p. m.	$T_0 + \Delta T_0$
$75^0\ 0'$	$23^h\ 49^m\ 8.^s0$	$4^h\ 36^m\ 10.^s0$	$2^h\ 12^m\ 57.^s75$
10	50 12.5	35 5.5	57.73
20	51 17.5	34 0.0	57.44
30	52 24.5	32 55.0	58.41
40	53 29.5	31 48.0	57.38
50	54 40.5	30 40.5	59.10
76 0	55 45.5	29 31.5	57.08
76 40	0 0 18.5	4 25 1.5	57.96
50	1 26.0	23 52.0	56.43
77 0	2 37.0	22 40.5	57.15
10	3 49.0	21 31.0	58.38
20	4 58.0	20 21.0	57.85
30	6 9.5	19 11.5	58.82
40	7 18.5	17 57.0	56.04
			2 12 57.68 $\pm$ 0.^{s}13
		E.:	6 2.06
		Chron. Corr. t. *(Error on)* Reykjavik M. T.	$2^h\ 6^m\ 55.^s62$
		— — „ (— „) Greenwich —	39 21.8
		Reykjavik W. Greenwich	$1^h\ 27^m\ 33.^s8$

Sættes $D_1 = 0$, da Hovedchronometret anvendtes til Observationerne, $D_2 = \pm\ 0.^s1$, $D_3 = \pm\ 0.^s15$, $D_4 = \pm\ 0.^s1$, $D_5 = \pm\ 0.^s1$, $D_6 = \pm\ 0.^s2$, $D_7 = \pm\ 0.^s25$, saa bliver den sandsynlige Fejl af den beregnede Længde

Now, putting $D_1 = 0$, the observations having been taken with the chief chronometer; $D_2 = \pm\ 0.^s1$, $D_3 = \pm\ 0.^s15$, $D_4 = \pm\ 0.^s1$, $D_5 = \pm\ 0.^s1$, $D_6 = \pm\ 0.^s2$, $D_7 = \pm\ 0.^s25$, the probable error of the computed longitude will be

$$D_\lambda = \pm \sqrt{(0.^s13)^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = \pm\ 0.^s41$$

Den af ovenstaaende Observationer beregnede Længde stemmer paa $2.^s7$ med den, der ifølge de Opgaver, som velvillig ere mig meddelte af Commandør Rothe, Directør for det Kongelige Danske Søkaart-Archiv i Kjøbenhavn, efter tidligere Iagttagelser og Beregninger er antaget som den sandsynligste, nemlig $1^h\ 27^m\ 36.^s6$. Observations-

The longitude computed from the observations given above agrees within $2.^s7$ with that which, according to the results kindly furnished me by Commodore Rothe, Hydrographer to the Royal Danish Navy, from former observations and computations, is deemed the most probable, viz. $1^h\ 27^m\ 36.^s6$, the point of observation lying about 38″,

punktet ligger nemlig 38″ eller 2.^{s}5 østenfor det Punkt ved Reykjavik, hvis Længde er antaget at være 21° 54′ 46″ eller 1^h 27^m 39.^{s}1.[1]

or 2.^{s}5, east of a point at Reykjavik of which the longitude is assumed to be 21° 54′ 46″, or 1^h 27^m 39.^{s}1.[1]

3. Namsos.

Corresponderende Højder. $\varphi = 64° 28.'2$, $\lambda = 0^h 46^m 6^s$ E. Greenw. Observationerne gjordes paa Nordsiden af Byen, c. 20 Skridt fra Stranden. Chron. Frodsham.

3. Namsos.

Equal altitudes; $\varphi = 64° 28.'2$; $\lambda = 0^h 46^m 6^s$ E. Gr. The observations were taken north of the town, about 20 paces from the shore. Frodsham's chronometer.

1876. August 19.

⊙ 2h′	Chron. a. m.	Chron. p. m.	$T_0 + \Delta T_0$
72° 50′	22^h 7^m 26.^{s}5	0^h 54^m 47.^{s}0	23^h 31^m 30.^{s}94
73 0	9 14.5	52 58.5	30.67
73 10	11 5.0	51 7.0	30.14
20	13 0.0	49 12.5	30.35
30	15 0.5	47 20.5	34.57
40	16 54.0	45 19.0	30.54
50	18 50.5	43 21.0	29.73
74 0	21 2.0	41 15.0	32.48
10	23 9.0	39 7.5	32.21
			23 31 31.29 ± 0.^{s}34
		E.	0 3 19.14
		Corr. t. *(Error on)* Namsos M. T.	+ 0 31 47.85

Den 19de August, 21^h 0^m 0.^{s}8 Greenwich M. T., var, ifølge Tidssignal pr. Telegraf, observeret directe efter Frodsham, af Capt. Wille, dette Chronometer 14^m 23.^{s}0 foran Greenwich M. T. Da Chronometret accelerede 5.^{s}12 i 24^h, bliver for Signaløjeblikket dets Correction til Namsos Middeltid $+ 31^m$ 43.^{s}22, og den af disse Tal resulterende Længde for Namsos

$$\lambda = 0^h\ 46^m\ 6.^s22 \text{ E. Greenwich}$$

med en sandsynlig Fejl af

On the 19th of August, 21^h 0^m 0.^{s}8 Greenwich M. T., Capt. Wille found the Frodsham chronometer, with which he observed the time-signals, to be 14^m 23.^{s}0 fast on Greenwich M. T.; and hence, gaining as it did 5.^{s}12 in twenty-four hours, the error on Namsos M. T. for the moment of despatch will be $+ 31^m$ 43.^{s}22, and the longitude of Namsos computed from these figures,

$$\lambda = 0^h\ 46^m\ 6.^s22 \text{ E. Greenw.}$$

with a probable error of

$$\pm \sqrt{(0.^s34)^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = \pm\ 0.^s49$$

Efter det af den geografiske Opmaaling construerede, endnu ikke udgivne, nyeste Kart over disse Egne ligger mit Observationspunkt 0° 46′ 29″ eller 0^h 3^m 5.^{s}9 E. Christiania, og skulde saaledes, med den her antagne

On the latest charts of these regions, constructed by the Geographical Survey but not yet published, my point of observation lies 0° 46′ 29″, or 0^h 3^m 5.^{s}9 E. Christiania, and should therefore, with the longitude here assumed

[1] Se ogsaa "Geografisk Tidskrift", udgivet af Bestyrelsen for det kongelige danske geografiske Selskab. 4de Bind, 1880, S. 111, 112.

[1] See also "Geografisk Tidskrift," edited by the Directors of the Royal Danish Geographical Society, Vol. 4, 1880, pp. 111, 112.

Længde for Christiania, $0^h\ 42^m\ 53.^s8$, ligge $0^h\ 45^m\ 59.^s7$ E. Greenwich, det er $6.^s5$ vestligere, end min astronomiske Bestemmelse giver. Nogen Grund til denne betydelige Forskjel formaar jeg ikke at angive.

for that place, viz. $0^h\ 42^m\ 53.^s8$, lie $0^h\ 45^m\ 59.^s7$ E. Greenwich, that is, $6.^s5$ farther west than determined by my astronomical observations. Any reason for so considerable a difference I am unable to suggest.

4. Bodø.

Samtidig med at Capt. Wille gjorde magnetiske Observationer, tog jeg den 13de August 1877 en Række Solhøjder paa et Sted nogle hundrede Skridt østenfor den østligste Landgangsbrygge. En Del af Højderne vare correspondcrende, en Række var Circummeridianhøjder, og senere om Eftermiddagen toges, med lav Solstand, en kort Række absolute Højder. Til de fleste Observationer benyttede jeg Chronometer Frodsham, men til nogle af Circummeridianhøjderne mit Duplexuhr, hvis Angivelser, efter samtidige Sammenligninger, umiddelbart reduceredes til Frodsham. Dette Chronometer sammenlignede jeg med Normalchronometret Reid Morgen og Aften.

Frodsham	19^h	54^m	$30.^s0$	7^h	0^m	$30.^s0$
Reid	18	50	46. 5	5	56	44. 25
Fr. Corr. t. Reid	— 1	3	43. 5	— 1	3	45. 75

Sextantens Indexfejl fandtes:

Før Middag	$+ 1'\ 58.''1 \pm 1.''8$	4 Observationer.
Efter Middag	$+ 1\ \ 50.\ 3 \pm 5.\ 2$	4 —
Om Aftenen	$+ 1\ \ 63.\ 5 \pm 1.\ 7$	4 —

Højderne ere beregnede med en Indexfejl af $+ 1'\ 57.''3$ indtil Frodsham $12^h\ 10^m\ 55^s$ og de følgende med $+ 1'\ 59.''5$.

Efter de ombord gjorte meteorologiske Iagttagelser var

Kl. 8 a. m.	Barometer	$770.^{mm}2$.	Temperatur	$21.^o0$ C.
„ 2 p. m.	—	69. 8.	—	21. 0
„ 8 p. m.	—	69. 3,	—	16. 0

Efter en foreløbig Beregning fandt jeg som approximative Værdier af Bredden og Længden $\varphi_0 = 67^\circ\ 17'\ 10''$ og $\lambda_0 = 0^h\ 57^m\ 39.^s6$. Kaldes den af disse Værdier for hvert Observationsøjeblik beregnede Højde af Solens Centrum h_0, den af Observationerne, rettede for Indexfejl, Refraction, Parallaxe og Solradius, fundne Højde h, den sandsynligste Værdi af Bredden og Længden $\varphi_0 + \varDelta\varphi$ og $\lambda_0 + \varDelta\lambda$, saa giver hver Observation en Ligning af Formen

$$-\cos a\ \varDelta\varphi - \cos\varphi\ \sin a\ \varDelta\lambda = h - h_0$$

hvor a er Azimuth. Af samtlige Ligninger udlededes ved de mindste Kvadraters Methode de sandsynligste Værdier af $\varDelta\varphi$ og $\varDelta\lambda$. Denne sidste Beregning er udført af Bestyreren af Bergens Observatorium, Hr. Åstrand, der efter min Anmodning velvillig paatog sig dette Arbejde.

Grupperes Differentserne mellem de observerede og de efter de fundne sandsynligste Værdier for Bredden og

4. Bodø.

Whilst Capt. Wille was engaged in making magnetical observations, I took on the 13th of August, 1877, a series of solar altitudes, from a point a few hundred paces east of the most easterly landing-pier. Part of them were equal altitudes, part (one series) circum-meridian altitudes, and later in the afternoon I took a short series of absolute altitudes. For most of the observations I used the Frodsham chronometer; but for some of the circum-meridian altitudes, my duplex watch, its indications, however, having been immediately compared with, and reduced to, those of the Frodsham. This chronometer I myself compared morning and evening with the Reid, our chief timekeeper.

Frodsham	19^h	54^m	$30.^s0$	7^h	0^m	$30.^s0$
Reid	18	50	46. 5	5	56	44. 25
Fr. Corr. to Reid	— 1	3	43. 5	— 1	3	45. 75

The index-error of the sextant was found to be —

Before Noon	$+ 1'\ 58.''1 \pm 1.''8$	4 Observations.
After Noon	$+ 1\ \ 50.\ 3 \pm 5.\ 2$	4 —
In the Evening	$+ 1\ \ 63.\ 5 \pm 1.\ 7$	4 —

The altitudes have been computed with an index-error of $+ 1'\ 57.''3$ up to $12^h\ 10^m\ 55^s$ Frodsham, and the remainder with an error of $+ 1'\ 59.''5$.

The results of the meteorological observations taken on board, were as follows: —

8 a. m.	Barometer	$770.^{mm}2$.	Temperature	$21.^o0$ C.
2 p. m.	—	69. 8.	—	21. 0
8 p. m.	—	69. 3.	—	16. 0

As approximate values for latitude and longitude, a preliminary computation gave $\varphi_0 = 67^\circ\ 17'\ 10''$ and $\lambda_0 = 0^h\ 57^m\ 39.^s6$. Now, if the altitude of the sun's centre, computed for each moment of observation from these values, be called h_0, the altitude found from the observations, after correction for the index-error, refraction, parallax, and the sun's semidiameter, h, the probable value of the latitude and longitude, $\varphi_0 + \varDelta\varphi$ and $\lambda_0 + \varDelta\lambda$, — then each observation will give an equation of the following form —

$$-\cos a\ \varDelta\varphi - \cos\varphi\ \sin a\ \varDelta\lambda = h - h_0$$

in which a signifies the azimuth. From all the equations were found, by the method of the least squares, the most probable values of $\varDelta\varphi$ and $\varDelta\lambda$. This computation was made by Mr. Åstrand, Director of the Bergen Observatory, who at my request kindly undertook the work.

On grouping the differences between the observed altitudes and the altitudes computed from the most pro-

Længden beregnede Højder efter de observerede Solrender, finder man, at i Gjennemsnit give nedre Solrands Observationer Højderne 6."8 for store, og øvre Solrands 6."6 for smaa. Den i Beregningen benyttede Solradius, 15′ 59."5, er saaledes for stor og bør, for at bringes i Overensstemmelse med Observationerne, formindskes til 15′ 52."8. Beregnes med denne Værdi faar man de nedenstaaende Værdier for Forskjellen mellem observerede og beregnede Højder, hvis Kvadratsum er Minimum.

bable values resulting for the latitude and longitude according to the observed solar limbs, the lower-limb observations are found to give on an average the altitudes 6."8 too high, the upper-limb 6."6 too low. Hence, the assumed semidiameter of the sun, — 15′ 59."5, will be too great, and should, to make it agree with the observations, be reduced to 15′ 52."8. Computed with these figures, we get the subjoined values for the difference between observed and computed altitudes, the sum of the squares of which is a minimum.

1877. August *(August)* **12—13.**

Chron. Frodsham.	Dobbelt aflæst Højde. (*Double obs. Altitude.*)	Obs. — Ber. Højde. (*Obs. — Calc. Alt.*)	Chron. Frodsham.	Dobbelt aflæst Højde. (*Double obs. Altitude.*)	Obs. — Ber. Højde. (*Obs. — Calc. Alt.*)
$21^h\ 26^m\ 35^s.0$	⊙ $62^0\ 40'\ 0''$	+ 8″	$0^h\ 4^m\ 22^s.0$	⊙ $75^0\ 8'\ 5''$	+ 1″
27 51.5	50 0	— 4	5 40.0	8 5	+ 3
29 8.5	63 0 0	— 19	7 51.0	7 0	— 1
30 23.0	10 0	— 18	9 7.0	6 55	+ 11
31 35.5	20 0	— 9	10 57.0	5 40	+ 2
32 50.0	30 0	— 5	12 2.0	5 0	+ 2
34 4.7	40 0	— 8	13 8.0	4 35	+ 13
35 22.5	50 0	+ 8	14 12.0	3 20	— 5
36 35.5	64 0 0	+ 3	15 16.0	2 20	— 5
21 38 44.5	⊙ 65 20 0	— 8	0 21 14.0	$\underline{\odot}$ 73 52 50	— 3
40 4.0	30 0	— 14	22 55.0	50 40	— 4
41 23.0	40 0	— 17	25 9.0	47 20	— 10
42 42.0	50 0	— 17	26 26.0	45 20	— 15
44 1.5	66 0 0	— 16	27 21.0	44 15	— 4
45 19.5	10 0	— 11	28 12.0	42 55	— 4
46 40.0	20 0	— 8	29 25.0	41 0	— 1
48 1.0	30 0	— 7	30 25.0	39 0	— 11
49 23.0	40 0	— 7	31 24.0	37 20	— 6
23 17 52.0	$\overline{\odot}$ 74 10 0	+ 9	0 36 27.0	$\overline{\odot}$ 74 31 5	— 13
19 47.0	14 30	— 14	37 33.0	28 40	0
20 51.0	18 15	+ 20	38 32.0	26 30	— 1
21 47.0	20 0	+ 5	39 25.0	24 20	— 4
22 33.0	22 0	+ 7	40 22.0	22 0	— 7
23 33.0	24 20	+ 8	41 18.0	20 0	0
24 25.0	26 30	+ 13	42 18.0	18 15	+ 14
25 28.0	28 40	+ 5	43 18.0	14 30	— 14
26 35.0	31 5	+ 7	45 13.0	10 0	+ 1
23 29 45.0	$\underline{\odot}$ 73 33 50	0	2 13 45.0	$\overline{\odot}$ 66 40 0	+ 7
31 20.0	36 40	+ 25	15 6.0	30 0	+ 2
32 39.0	39 30	+ 19	16 29.5	20 0	+ 9
34 32.0	42 25	0	17 48.5	10 0	— 10
36 4.0	45 5	+ 6	19 6.7	0 0	— 3
38 46.0	49 20	+ 14	20 28.0	65 50 0	+ 2
39 57.0	50 50	+ 7	21 46.0	40 0	— 2
41 0.0	52 5	+ 6	23 4.0	30 0	+ 1
41 55.0	53 10	+ 2	24 23.0	20 0	+ 5
23 55 32.0	$\underline{\odot}$ 74 3 55	— 8	2 26 32.0	$\underline{\odot}$ 64 0 0	+ 13
57 10.0	4 10	— 1	27 47.5	63 50 0	+ 17
58 12.0	4 25	— 2	29 3.0	40 0	+ 9
59 16.0	4 25	— 7	30 15.5	30 0	— 3
0 0 2.0	4 40	— 3	31 34.0	20 0	+ 14
1 0.0	4 35	— 7	32 46.5	10 0	+ 4
2 4.0	4 30	— 11	34 1.5	0 0	+ 4
2 46.0	4 25	— 11	35 16.0	62 50 0	+ 7
3 26.0	4 30	— 7	36 28.5	40 0	— 15
5 45 23.0	$\underline{\odot}$ 29 30 0	+ 1	5 50 48.0	⊙ 29 30 0	+ 9
47 4.0	10 0	+ 12	51 41.0	20 0	+ 14
47 56.0	0 0	+ 13	52 31.0	10 0	+ 3
48 46.0	28 50 0	+ 2	53 24.5	0 0	+ 12

Ifølge Tidssignal var den 12te August $9^h\ 0^m\ 1.^s3$ a. m. Chronometer Reid's Correction til Greenwich Middeltid $+ 8^m\ 40.^s8$, der voxer med $0.^s97$ i 24^h. Herefter bliver Correctionen for Reid til Greenwich Middeltid ved den første Observation om Formiddagen $+ 8^m\ 41.^s8$, ved den sidste af de correspondérende Højder om Eftermiddagen $+ 8^m\ 42.^s0$ og ved Aftenobservationerne $+ 8^m\ 42.^s1$.

Af Ligningerne findes den sandsynlige Fejl af en enkelt Højde

$$\delta = \pm\ 6.''3$$

og de sandsynligste Værdier for

On the 12th of August, $9^h\ 0^m\ 1.^s3$ a. m., the correction for the Reid chronometer to Greenwich mean time, as determined by the time-signals, was $+ 8^m\ 40.^s8$, increasing $0.^s97$ in twenty-four hours. Hence, the Reid correction to Greenwich mean time for the first observation in the forenoon, will be $+ 8^m\ 41.^s8$; for the last of the equal altitudes in the afternoon $+ 8^m\ 42.^s0$; and for the evening observations $+ 8^m\ 42.^s1$.

From the equations, the probable error of a single altitude is found to be

$$\delta = \pm\ 6.''3,$$

and the most probable values for

$$\Delta\varphi = +\ 3.''9 \pm 0.''74 \qquad \Delta\lambda = -2.''4 \pm 3.''3 = -0.^s19 \pm 0.^s22$$

Forudsættes en sandsynlig constant Fejl af $\pm\ 10''$ i de maalte Højder, vil denne i den beregnede Bredde give en sandsynlig Fejl af $\pm\ 10.''76$, og man faar saaledes som Resultat

$$\varphi = 67^\circ\ 17'\ 13.''9 \pm 10.''8$$

En constant Fejl af $10''$ i de maalte Højder giver en Fejl af $0.^s51$ i Længden. Den sandsynlige Fejl af den beregnede Længde kan derfor sættes lig

If we assume a probable constant error of $\pm\ 10''$ in the observed altitudes, this error will affect the computed latitude with a probable error of $\pm\ 10.''76$, and the final result will be

$$\varphi = 67^\circ\ 17'\ 13.''9 \pm 10.''8.$$

A constant error of $10''$ in the observed altitudes, entails an error of $0.^s51$ in longitude. The probable error of the computed longitude may accordingly be put at

$$\sqrt{(0.^s22)^2 + (0.^s51)^2 + D_1^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = 0.^s63$$

og man faar som Resultat

$$\lambda = 0^h\ 57^m\ 39.^s4 \pm 0.^s63 \text{ E. Greenwich}$$
$$= 14^\circ\ 24'\ 51'' \pm 9.''5 \quad „ \quad —$$

Ifølge de norske Kystkarter ligger mit Observationspunkt paa

Bredde $67^\circ\ 17'\ 15''$

Længde $14^\circ\ 25'\ 40'' = 0^h\ 57^m\ 42.^s7$ E. Greenwich.

Der er saaledes meget god Overensstemmelse i Bredden, medens min Bestemmelse lægger Bodø $3.^s3$ vestligere end Kartet, en Afstand, der svarer til 594 Meter.

and the final result will be

$$\lambda = 0^h\ 57^m\ 39.^s4 \pm 0.^s63 \text{ E. Greenwich}$$
$$= 14^\circ\ 24'\ 51'' \pm 9.''5 \quad „ \quad —$$

On the Norwegian coastal charts my point of observation is, in

Latitude $67^\circ\ 17'\ 15''$

Longitude $14^\circ\ 25'\ 40'' = 0^h\ 57^m\ 42.^s7$ E. Greenwich.

Hence the agreement in latitude is quite satisfactory, whereas my determination, as compared with the chart, places Bodø $3.^s3$ farther west, a difference corresponding to 594 metres.

5. Røst.

Observationerne toges paa en større Holme, Skruholmen kaldet, den 26de Juni 1877. Ved Middagstider toges en Række Circummeridianhøjder og om Eftermiddagen en Række Højder i Nærheden af første Vertical. Ved den første Række benyttede jeg mit Duplexuhr, der sammen-

5. Røst.

The observations were made on a large holm, or islet, called Skruholmen, June the 26th 1877. At noon were taken a series of circum-meridian altitudes, and in the afternoon a series of altitudes near the prime vertical. For the first series, I used my duplex watch, which, imme-

lignedes, umiddelbart efter at Observationerne vare tagne, med Chronometer Frodsham, og hvis Angivelser paa Stedet reduceredes til dette. Ved Eftermiddagsobservationerne benyttede jeg Frodsham.

Indexfejlen fandtes ved Middag $= + 2' \; 8.''8 \pm 5''$. 5 Obs.
om Efterm. $= + 2 \; \; 1. \; 7 \pm 2$. 3 „

	8 a. m.	2 p. m.	8 a. m.
Barometer	750.mm6	750.mm6	749.mm2
Temperatur	8.°9	9.°0	8.°9

Efter Tidssignal, observeret i Bodø den 24de Juni, er for Frodshams Chronometer beregnet for Eftermiddagsobservationerne Correction til Greenwich Middeltid

$$-0^h \; 52^m \; 12.^s7.$$

Som foreløbige Værdier er sat

diately after taking the observations, was compared with the Frodsham chronometer, and its several indications reduced on the spot to those of the latter timepiece. For the afternoon-series, I used the Frodsham.

Index-error at Noon $= + 2' \; 8.''8 \pm 5''$. 5 Observations.
— after Noon $= + 2 \; \; 1. \; 7 \pm 2$. 3 —

	8 a. m.	2 p. m.	8 a. m.
Barometer	750.mm6	750.mm6	749.mm2
Temperature	8.°9	9.°0	8.°9

The Frodsham correction to Greenwich mean time, as determined from the time-signals at Bodø on the 24th of June, was found to be

$$-0^h \; 52^m \; 12.^s7.$$

As approximate values,

$$\varphi_0 = 67^0 \; 29' \; 50'' \text{ and } \lambda_0 = 0^h \; 48^m \; 29.^s1 \text{ E. Greenwich.}$$

1877. Juni *(June)* 26.

Chron. Frodsham.	2h′	Δ
$0^h \; 13^m \; 6.^s6$	⊙ 92° 13′ 45″	− 7″
14 6.6	13 20	− 6
15 6.6	12 50	− 3
19 6.6	10 0	− 3
20 36.6	8 30	− 9
21 58.6	7 30	+ 4
22 36.6	6 30	− 6
24 30.6	⊙ 91 1 35	+ 7
25 28.6	0 10	− 2
26 38.6	90 59 5	+ 14
27 46.6	57 30	+ 14
29 8.6	55 30	+ 14
29 51.6	54 0	+ 1
30 54.6	51 50	− 16

Chron. Frodsham.	2h′	Δ
$4^h \; 46^m \; 31.^s7$	$\underline{\odot}$ 57° 40′ 0″	− 14″
47 26.7	30 0	− 2
48 19.0	20 0	+ 4
49 12.5	10 0	− 2
50 6.5	0 0	+ 4
50 58.7	56 50 0	+ 1
51 51.0	40 0	− 2
52 43.8	30 0	− 3
53 35.5	20 0	− 8
55 37.0	⊙ 57 0 0	+ 4
56 30.0	56 50 0	+ 3
57 22.0	40 0	− 1
58 15.8	30 0	+ 6
59 8.5	20 0	+ 8
5 0 0.2	10 0	+ 1
0 54.5	0 0	+ 12
1 45.5	55 50 0	− 3
2 38.8	40 0	+ 7

Differentserne Δ mellem de observerede og beregnede Højder ere tagne efterat den benyttede Solradius er formindsket med 7.″2 forat tilfredsstille Observationerne af begge Solrender.

Efter de mindste Kvadraters Methode har Hr. Åstrand fundet

The differences, Δ, between the observed and the computed altitudes, were found after diminishing the assumed semidiameter of the sun by 7.″2, to satisfy the observations of both limbs.

By the method of the least squares, Mr. Åstrand found

$$\delta = \pm \; 5.''1; \quad \Delta\varphi = -2.''6 \pm 1.''4; \quad \Delta\lambda = + \; 0.^s69 \pm 0.^s21.$$

Forudsættes en sandsynlig constant Fejl af $\pm$ 10″, bliver dens Virkning paa den beregnede Bredde $\pm$ 9.″9, og Resultatet bliver

$$\varphi = 67^0 \; 29' \; 47.''4 \pm 10.''0.$$

Assuming a probable constant error of $\pm$ 10″, the effect on the computed latitude will be $\pm$ 9.″9, and the result therefore

$$\varphi = 67^0 \; 29' \; 47.''4 \pm 10.''0.$$

En constant Fejl af 10″ i de maalte Højder giver en Fejl af 1.ˢ66 i den beregnede Længde. Sættes den sandsynlige Fejl af den beregnede Længde lig

A constant error of 10″ in the observed altitudes entails an error of 1.ˢ66 in the computed longitude. Putting the probable error of the computed longitude at

$$\sqrt{(0.^s21)^2 + (1.^s66)^2 + D_1^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = \pm 1.^s72$$

faaes som Resultat

the result will be

$$\lambda = 0^h\ 48^m\ 29.^s8 \pm 1.^s72 = 12^\circ\ 7'\ 27'' \pm 25.''8 \text{ E. Greenwich.}$$

Efter de norske Kystkarter ligger Skruholmen paa
Bredde 67° 29′ 48″
Længde 12° 6′ 36″ = $0^h\ 48^m\ 26.^s4$ E. Greenwich.

Der er saaledes god Overensstemmelse i Bredden, medens min Bestemmelse lægger Røst 51″ eller 3.ˢ4 østligere end Kartet, en Afstand, der svarer til 602 Meter.

On the Norwegian coastal charts, Skruholmen is in
Latitude 67° 29′ 48″
Longitude 12° 6′ 36″ = $0^h\ 48^m\ 26.^s4$ E. Greenwich.

Hence the agreement in latitude is quite satisfactory, whereas my determination of longitude, as compared with the chart, places Røst 51″, or 3.ˢ4, farther east, a difference corresponding to 602 metres.

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6. Hammerfest.

Observationerne gjordes om Eftermiddagen den 9de Juli og om Morgenen den 10de Juli 1878 paa Fuglenes i Meridian-Støttens Meridian, omtrent 5 Meter i Syd for samme. Polhøjden af Meridian-Støtten, der danner det nordlige Endepunkt af den Russisk-Svensk-Norske Gradmaaling, er bestemt af Professor Lindhagen til 70° 40′ 11.″3. Omstændighederne vare meget gunstige, Luften klar og rolig.

6. Hammerfest.

The observations were taken in the afternoon of the 9th of July and on the morning of the 10th, 1878, at Fuglenes, in the meridian of the "Meridian-Column," about 5 metres farther south. The latitude of the Column, which constitutes the northern terminal point of the Russian-Swedish-Norwegian arc of meridian, has been determined by Professor Lindhagen at 70° 40′ 11.″3. Circumstances were remarkably favourable, the atmosphere both clear and still.

Den 9de Juli Eft. fandtes Indexfejlen (*Index-error p. m.)* + 2′ 7.″2 ± 2.″2. 6 Obs.
„ 10de „ Form. — — (— *a. m.)* + 2 3. 3 ± 3. 1. 3 „

Som Observationsuhr benyttede jeg mit Lommechronometer.

For these observations, I used my pocket-chronometer.

Chron. Reid Juli 9	*(Reid's Chronometer)*	$2^h\ 21^m\ 30.^s0$	$6^h\ 25^m\ 0.^s0$	$17^h\ 7^m\ 0.^s0$	$19^h\ 23^m\ 0.^s0$	$20^h\ 3^m\ 30.^s0$.
Lommechron. „ 9	*(Pocket-chronometer)*	3 15 14.0	7 18 42.9	18 0 41.7	20 16 41.1	20 57 10.9.
Corr. t. Reid	*(Corr. to Reid)*	— 53 44.0	— 53 42.9	— 53 41.7	— 53 41.1	— 53 40.9.

Juli 9 Eft. Barom. 760.ᵐᵐ0 Temp. 8°
„ 10 Morgen — 759.ᵐᵐ3 — 11°

Paa Telegrafcontoret i Hammerfest observerede jeg den 10de Juli

Lommechronometer	$8^h\ 38^m\ 22.^s0$	
Corrigeret Tidssignal	8 0 1. 2	Greenwich M. T.
Corr. af Lommechron.	— 38 20. 8	til Gr. M. T.
„ „ —	53 41. 0	„ Reid.
Corr. for Reid	+ 15 20. 2	til Greenwich M. T.

July 9 p. m. Barom. 760.ᵐᵐ0 Temp. 8°
„ 10 a. m. — 759.ᵐᵐ3 — 11°

At the telegraph-office in Hammerfest, I observed on the 10th of July

Pocket-chronometer	$8^h\ 38^m\ 22.^s0$	
Corrected Time-signals	8 0 1. 2	Greenwich M. T.
Corr. for Pocket-chron.	— 38 20. 8	to Gr. M. T.
— —	53 41. 0	to the Reid chron.
Corr. for the Reid	+ 15 20. 2	to Greenwich M. T.

Med Polhøjden 70° 40′ 11.″2 beregnede Hr. Åstrand Længden saaledes:

With the latitude 70° 40′ 11.″2, Mr. Åstrand computed the longitude as follows: —

Af Observationerne Juli 9 Eft. (*From the observations July 9th p. m.*)	⊙	$1^h\ 34^m\ 44.^s5$	$1^h\ 34^m\ 43.^s95$
	$\underline{\odot}$	1 34 43. 4	
Juli 10 Morg. (— „ — *July 10th a. m.*)	$\underline{\odot}$	1 34 40. 7	1 34 40. 60
	⊙	1 34 40. 1	

For at bringe Eftermiddagsobservationerne af begge Solrender i Overensstemmelse, trænger den benyttede Solradius en Tilvæxt af 2.″7. For Morgenobservationernes Vedkommende trænges en Tilvæxt af 1.″4.

De to Observationsrækker give, som man ser, merkelig forskjellige Værdier af Længden. Sammenstillingen af de af begge udledede Uhrcorrectioner giver for Normalchronometret Reid en Acceleration af flere Secunder i Mellemtiden, 14 Timer, medens dette Chronometer stadig, ifølge Tidssignalerne, har en Retardation af henimod et Secund i Døgnet. De ovenfor anførte Uhrsammenligninger vise ogsaa, at Lommechronometret den hele Tid retarderer i Forhold til Reid, men langsommere i Løbet af Natten, medens det modsatte maatte være Tilfældet, om Reid i Løbet af Natten havde accelereret. Jeg tør derfor ikke lægge Skylden for Uoverensstemmelsen mellem de beregnede Resultater af Eftermiddags- og Morgen-Observationerne paa Chronometret. Da Højderne ikke ere langt fra at være corresponderende, antager jeg Tilstedeværelsen af en constant Fejl i alle maalte Højder, og har efter de mindste Kvadraters Methode søgt den sandsynligste Værdi af denne samtidig med den sandsynligste Værdi af Længden. Til denne Beregning kunde jeg benytte de Beregninger, som Hr. Åstrand, efter min Opfordring, havde gjort, uden at antage nogen constant Fejl. Som foreløbig Værdi for Længden satte jeg $\lambda_0 = 1^h\ 34^m\ 41.^s6$ og indførte de ovenfor nævnte Correctioner for den apparente Solradius.

To satisfy the p. m. observations of both solar limbs, will require an increase in the semidiameter of the sun of 2.″7. For the a. m. observations, is needed an increase of 1.″4.

The two series of observations give remarkably different values for the longitude. A comparison of the chronometer-errors deduced from both indicates for the chief chronometer — the Reid — an acceleration of several seconds during the interval (14 hours), whereas that chronometer, according to the time-signals, invariably exhibited a retardation of one second in twenty-four hours. Moreover, the comparisons of the respective timekeepers show the pocket-chronometer, as compared with the Reid, to have been steadily gaining, — more slowly however in the course of the night; whereas the reverse must have been the case had the Reid gained in the night. Hence, I cannot ascribe this want of agreement between the computed results of the p. m. and a. m. observations to the chronometer. The altitudes being very nearly equal, I have assumed the presence of a constant error in all the observed altitudes, and by the method of the least squares sought to find its most probable value, together with the most probable value of the longitude. For this computation, I could apply the greater part of the calculations kindly made at my request by Mr. Åstrand, who had not assumed any constant error. As a preliminary value for the longitude, I put $\lambda_0 = 1^h\ 34^m\ 41.^s6$, introducing also the above-mentioned corrections for the sun's apparent semidiameter.

1878. Juli *(July)* 9.

Lommechronometer. *(Pocket-Chronometer.)*	2h′	Δ
$4^h\ 15^m\ 26.^s0$	$\underline{\odot}$ 50° 20′	+ 4″
16 27.6	10	+ 8
17 27.1	0	+ 3
18 26.0	49 50	− 5
19 26.4	40	− 6
20 27.6	30	− 3
21 29.2	20	+ 1
22 28.8	10	− 3
23 29.6	0	− 4
4 26 52.0	$\overline{\odot}$ 49 30	+ 5
27 51.2	20	− 0
28 51.2	10	− 4
29 51.2	0	− 7
30 52.8	48 50	− 2
33 54.4	20	− 0
34 56.4	10	+ 8
35 56.0	0	+ 6
36 56.4	47 50	+ 3
37 55.2	40	− 3

Lommechronometer. *(Pocket-Chronometer.)*	2h′	Δ
$18^h\ 50^m\ 48.^s4$	$\overline{\odot}$ 59° 10′	− 14″
51 50.4	20	− 10
52 54.4	30	− 7
53 56.4	40	− 3
54 59.6	50	− 4
56 2.4	60 0	+ 1
57 8.4	10	− 10
58 10.4	20	− 1
59 13.2	30	+ 4
19 0 18.0	40	− 1
1 21.4	50	+ 4
2 23.6	61 0	+ 13
3 28.8	10	+ 8
4 34.0	20	+ 6
19 7 5.6	$\underline{\odot}$ 60 40	− 2
8 9.6	50	+ 2
9 13.2	61 0	+ 8
10 20.4	10	− 2
11 23.6	20	+ 7
12 30.4	30	+ 1
14 42.4	50	− 4
15 45.2	62 0	+ 10
16 52.8	10	+ 2
18 0.0	20	− 4
19 5.2	30	+ 10
20 12.8	40	− 5
21 20.0	50	− 9
22 24.8	63 0	+ 0

Beregningen giver $\delta = \pm\ 4.''0$.

$\Delta\lambda = +\ 11.''5 \pm 1.''8 = +\ 0.^s77 \pm 0.^s12$; Const. Corr. paa Højderne $= +\ 8.''0 \pm 0.''6$ og som Resultat, naar den sandsynlige Fejl af den beregnede Længde sættes

The computation gives $\delta = \pm\ 4.''0$.

$\Delta\lambda = +\ 11.''5 \pm 1.''8 = +\ 0.^s77 \pm 0.^s12$; const. corr. in the altitudes $= +\ 8.''0 \pm 0.''6$, and as result, the probable error of the computed longitude being put

$$= \sqrt{(0.^s12)^2 + D_1^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = \pm\ 0.^s41$$

$$\lambda = 1^h\ 34^m\ 41.^s7 \pm 0.^s41 = 23°\ 40'\ 25.''8 \pm 6.''1 \text{ E. Greenwich.}$$

Den sandsynlige Fejl svarer til en Afstand af 74 Meter.

Efter Professor Fearnleys Beregning af Gradmaalingen, med Udgangspunkt Dorpat, skulde Længden af Meridianstøtten paa Fuglenes være 23° 40′ 0.″9 E. Gr. Efter den af Svenskerne (Meddelelse fra Prof. Rosén til den geografiske Opmaaling) senere udførte telegrafiske Længdebestemmelse af Kokkomäki ($\varphi = 65°\ 49'\ 16''$) — Stockholm, bliver Længden af Meridianstøtten paa Fuglenes

$$23°\ 40'\ 22.''1 = 1^h\ 34^m\ 41.^s5 \text{ E. Gr.}$$

fra hvilken Bestemmelse min afviger kun 3.″7 eller 0.ˢ25, der svarer til en Afstand af 39 Meter.

The probable error corresponds to a distance of 64 metres.

According to Professor Fearnley's computation from the triangulation, — starting from Dorpat, — the longitude of the Meridian Column at Fuglenes should be 23° 40′ 0.″9 E. Gr. Meanwhile, the telegraphic determination of longitude for Kokkomäki ($\varphi = 65°\ 49'\ 16''$) — Stockholm, subsequently performed by Swedish astronomers (communication from Professor Rosén to the Geographical Survey), places the Meridian Column at Fuglenes in longitude

$$23°\ 40'\ 22.''1 = 1^h\ 34^m\ 41.^s5 \text{ E. Greenwich}$$

from which result my determination differs only 3.″7, or 0.ˢ25, corresponding to 39 metres.

De norske Kystkarter give for samme Punkt

$$\varphi = 70^\circ\ 40'\ 25'' \text{ og } \lambda = 23^\circ\ 39'\ 54''$$

altsaa Bredden 14″ for stor og Længden c. 30″ eller 2ˢ for liden (310 Meter).

The Norwegian coastal charts give for the point in question

$$\varphi = 70^\circ\ 40'\ 25'' \text{ ano } \lambda = 23^\circ\ 39'\ 54''$$

the latitude, therefore, 14″ too far north, and the longitude about 30″, or 2ˢ (310 metres), not far enough east.

7. Vardø.

Observationerne gjordes den 26de Juni 1878 omkring Middag paa et Punkt, der, ifølge Observationer med Theodolithen, ligger 175 Meter Nord og 51 Meter Vest for Midtpunktet af Fæstningen Vardøhus. Luften, der i Begyndelsen var klar, blev efter Middag taaget, saa at den sidste Række Højder maatte tages med svage Blændglas foran begge Spejle, og tilsidst maatte Observationerne afbrydes, da det skyede ganske over. Jeg opnaaede saaledes ikke at faa lige mange Højder af hver Solrand, og Indexfejlens Bestemmelse blev mangelfuld. I Middel af 4 Bestemmelser fandtes Indexfejlen $+ 2'\ 13'' \pm 3''$.

Som Observationsuhr benyttede jeg mit Lommechronometer.

Reid	$18^h\ 43^m\ 0^s.0$
Lommechron.	19 37 52.8
Corr. t. Reid	− 54 52.8

Lommechronometret taber i Forhold til Reid $0^s.23$ pr. Time.

Efter de meteorologiske Observationer i Vardø var:

Juli 26	8 a. m.	Barom.	$765.^{mm}9$	Temp.	C.	$6.^\circ0$
— „	2 p. m.	—	765.9	—	„	9.4

7. Vardø.

The observations were taken on the 26th of June, 1878, about noon, from a point which, as determined with the theodolite, lies 175 metres north and 51 metres west of the centre of Vardøhus fortress. The atmosphere, clear at first, soon got hazy, so that the last series of altitudes had to be taken with light-coloured glasses, and ere long the observations had to be broken off, the sky becoming quite overcast. Hence, I did not succeed in getting an equal number of altitudes of each solar limb; and the index-error was not very well determined. As a mean of 4 observations, the index-error was found to be $+ 2'\ 13'' \pm 3''$.

On this occasion, I observed with my pocket-chronometer.

Reid	$18^h\ 43^m\ 0^s.0$
Pocket-chron.	19 37 52.8
Corr. to the Reid	− 54 52.8

The pocket-chronometer was losing hourly $0^s.23$ more than the Reid.

The meteorological observations at Vardø gave the following results: —

July 26	8 a. m.	Barom.	$765.^{mm}9$	Temp.	C.	$7.^\circ0$
— „	2 p. m.	—	765.9	—	„	9.4

1878. Juni *(June)* **25—26.**

Lommechron. (*Pocket-Chronometer.*)	2 h′	Δ
21^h 31^m $36.^s8$	$\underline{\odot}$ 83° 30′ 0″	− 0″
33 8.0	35 0	− 10
34 30.8	40 0	− 2
35 58.8	45 0	+ 1
37 30.0	50 0	+ 1
39 5.2	55 0	− 1
40 41.2	84 0 0	0
42 17.6	5 0	+ 4
44 5.6	10 0	− 5
52 36.4	$\underline{\odot}$ 85 36 10	+ 4
53 45.6	38 35	− 7
54 52.4	41 25	− 1
55 58.4	43 50	− 5
57 17.2	46 30	− 13
58 27.6	49 10	− 4
59 53.6	52 30	+ 0
22 1 44.4	56 0	− 6
2 57.6	58 10	− 12
4 51.2	86 2 0	− 11
5 43.6	3 35	− 1
7 17.6	6 5	− 5
8 18.8	7 45	− 6
9 59.6	10 50	+ 7
11 32.4	13 10	+ 9
12 40.0	14 30	+ 2
13 37.6	15 40	− 2
14 48.8	17 5	− 5
15 36.4	18 0	− 7
17 0.8	19 50	− 1
17 58.8	21 0	+ 1

Lommechron. (*Pocket-Chronometer.*)	2 h′	Δ
22^h 18^m $54.^s4$	$\overline{\odot}$′ 86° 22′ 0″	+ 2″
19 55.6	23 5	+ 8
20 46.0	24 30	+ 22
22 58.0	25 55	+ 7
24 16.8	26 40	− 1
24 59.2	27 20	+ 2
25 55.8	27 45	− 3
26 44.8	28 35	+ 7
27 45.6	28 40	− 7
28 32.8	29 20	− 0
30 27.2	30 0	+ 9
31 32.0	31 0	+ 12
32 31.2	31 10	+ 8
22 37 17.2	$\underline{\odot}$ 85 28 20	− 6
38 29.6	28 35	+ 2
39 28.0	28 35	+ 4
40 37.2	28 35	+ 9
41 30.8	28 5	− 1
42 45.2	27 40	− 6
43 50.4	27 20	− 3
45 24.0	26 45	− 4
47 34.8	26 0	+ 5
49 32.4	25 0	+ 11
23 43 6.0	$\overline{\odot}$ 84 35 0	− 2
44 34.0	30 0	− 4
45 55.2	25 0	− 13
47 29.4	20 0	+ 0
48 50.0	15 0	+ 11
50 1.6	10 0	+ 5
51 14.0	5 0	− 5

I Betingelsesligningerne har Hr. Åstrand indført en Correction ($\Delta\,\varrho$) for den benyttede Solradius. Som tilnærmede Værdier er antaget $\varphi_0 = 70°\ 22'\ 28.''3$ og $\lambda_0 = 2^h\ 4^m\ 28.^s8$, og Reids Correction til Greenwich Middeltid ved Observationernes Begyndelse sat til $+\ 15^m\ 8.^s1$.

Af Ligningerne findes:

In the equations of condition, Mr. Åstrand introduced a correction ($\Delta\,\varrho$) for the assumed semidiameter of the sun. As approximate values, he put $\varphi_0 = 70°\ 22'\ 28.''3$ and $\lambda_0 = 2^h\ 4^m\ 28.^s8$, and the Reid correction to Greenwich mean time at the beginning of the observations $= +\ 15^m\ 8.^s1$.

From the equations, he found

$$\delta = \pm\ 4.''6;\ \Delta\,\varrho = +\ 5.''9 \pm 0.''66$$
$$\Delta\,\varphi = -\ 4.''3 \pm 0.''7;\ \Delta\,\lambda = +\ 34.''4 \pm 9.''4 = +\ 2.^s29 \pm 0.^s63.$$

Antages en sandsynlig constant Fejl i de maalte Højder af $\pm\ 10''$, saa er dennes Indflydelse paa den beregnede Bredde $\pm\ 11.''4$, og paa den beregnede Længde $\pm\ 0.^s39$. Resultatet bliver:

Assuming a probable constant error in the observed altitudes of $\pm\ 10''$, its effect on the computed latitude will be $\pm\ 11.''4$, and on the computed longitude $\pm\ 0.^s39$; as result we get

$$\varphi = 70°\ 22'\ 24.''0 \pm 11.''4$$
$$\lambda = 31°\ \ 7'\ 46.''4 \pm 12.''6 = 2^h\ 4^m\ 31.^s1 \pm 0.^s84 \text{ E. Greenwich.}$$

Reduceres til Fæstningens Midte faaes: Vardøhus

Reduced to the centre of the fortress, we get for Vardøhus —

$$\varphi = 70°\ 22'\ 18.''4 \pm 11.''4$$
$$\lambda = 31°\ \ 7'\ 51.''3 \pm 12.''6 = 2^h\ 4^m\ 31.^s4 \pm 0.^s84 \text{ E. Greenwich.}$$

Efter de norske Kystkarter ligger Vardøhus paa:
Bredden 70° 22′ 5″
Længden 31° 7′ 35″ = 2^h 4^m 30.ˢ3 E. Greenwich.

Efter en senere fundet Correction for en Regnefejl skulde imidlertid Punkterne østenfor Nordkap ligge c. 22″ østligere end i Kartet, altsaa Vardøhus paa Længden 31° 7′ 57″ = 2^h 4^m 31.ˢ8, hvilken Værdi kun er 6″ eller 0.ˢ4 større end den af mig fundne.

On the Norwegian coastal charts, Vardøhus is in
Latitude 70° 22′ 5″
Longitude 31° 7′ 35″ = 2^h 4^m 30.ˢ3 E. Greenwich.

Meanwhile, the points east of the North Cape should, according to an error of calculation subsequently discovered, lie about 22″ farther east than on the chart. Vardøhus therefore in longitude 31° 7′ 57″ = 2^h 4^m 31.ˢ8; and this value exceeds my determination by only 6″, or 0.ˢ4.

Sammenstilles de af mig fundne Længder med de paa de norske Kystkarter udmaalte, faar man følgende Oversigt:

A comparison between my determinations of longitude and those on the respective Norwegian charts gives the following results: —

	Astron. telegr. Længde. (Longitude Astr. Telgh.)	Kartets Længde. (Long. on Chart.)	Forskjel. (Difference.)	
Namsos . . .	11° 31′ 33″ ± 7.″4	11° 30′ 45″	45″ =	3.ˢ0
Bodø	14 24 51 ± 9.5	14 25 40	— 49 =	— 3.3
Røst	12 7 27 ± 25.8	12 6 36	59 =	3.4
Hammerfest . .	23 40 26 ± 6.1	23 39 54	32 =	2.1
Vardø	31 7 51 ± 12.6	31 7 35	16 =	1.1

Med Undtagelse af Bodø ere Kartets Længder mindre østlige end mine. Forskjellen er imidlertid kun en Brøkdel af et Minut, i Storcirkel kun en Brøkdel af et halvt til et Trediedels Minut, og Tilstrækkeligheden af Nøjagtigheden af Karternes Længde for Skibsfarten antages saaledes godtgjort. Karternes Bredder synes gjennemgaaende nøjagtige, saavidt ovenstaaende Iagttagelser kunne tjene til deres Verification.

Saving that of Bodø, the longitudes on the chart are none of them so far east as mine. Meanwhile, the difference does not amount to more than a fraction of a minute, and in arc of great circle it is only a fraction of half to one-third of a minute; hence, the accuracy of the longitudes on the charts may be regarded as sufficient for all practical purposes of navigation. The latitudes on the charts would appear to be generally correct, so far as the results set forth above can serve for their verification.

8. Advent Baj.

Paa Odden, ved den vestre Bred af Indløbet til Advent Baj, der gaar i sydostlig Retning ind fra den indre Del af Isfjorden paa Spidsbergens Vestkyst, tog jeg den 20de August 1878 to Rækker Solhøjder til Bestemmelse af Bredden og Længden af det Punkt, der var Udgangspunktet for Iagttagelserne til Constructionen af det Kart, som Capt. Wille optog over Bajen med Omgivelser.

Omstændighederne vare ikke meget gunstige. Luften var tildels meget taaget, saaat Blændglassene ofte maatte vexles, ja kunde stundom endog undværes. En Følge af

8. Advent Bay.

On the tongue of land jutting out from the western shore of the entrance to Advent Bay, which extends in a south-easterly direction from the inner part of Ice Sound on the west coast of Spitsbergen, I took on the 20th of August, 1878, two series of solar altitudes, to determine the latitude and longitude of the point at which were commenced the observations for the survey made by Capt. Wille of the Bay and its environs.

Circumstances were anything but favourable, the atmosphere being so hazy at intervals that the coloured glasses had to be frequently changed, nay could now and again

disse Omstændigheder var det desværre, at jeg ikke kunde faa nogen brugbar Bestemmelse af Indexfejlen. Denne har jeg senere søgt at finde saaledes:

be dispensed with. As a consequence of these atmospheric conditions, I failed to obtain a trustworthy determination of the index-error. This I sought subsequently to find in the following manner: —

I Hammerfest den 9de Juli 1878 ved en Temperatur af + 8° C. var Indexfejlen *(Index-error)* + 2′ 7″
„ — „ 10de „ — „ „ — „ + 10 „ „ — — + 2 3
„ Christiania „ 11te Decb. — „ „ — „ — 3 „ „ — — + 2 27

Under Observationerne i Advent Baj var Luftens Temperatur + 3°, hvortil, efter grafisk Interpolation, svarer en Indexfejl af + 2′ 16″, der er benyttet til Beregningen af Højderne.

Den benyttede Solradius er den, som er udledet af Sammenligning mellem Observationerne af øvre og nedre Solrand.

Observationsuhr var mit Lommechronometer, der før og efter sammenlignedes med Hovedchronometret Reid ombord.

Reid	19^h	4^m	$0.^s0$	0^h	55^m	$0.^s0$
Lommechron.	19	53	58.6	1	44	57.2
Corr. t. Reid	—	49	58.6	—	49	57.2

Efter de timevise meteorologiske Iagttagelser ombord var

ved Morgenobs. Kl. 9 a. m. Barom. = $755.^{mm}1$ Temp. = $3.^\circ0$
„ Efterm.obs. „ 1 p. m. — 755. 0 — 2. 6

During the observations taken at Advent Bay, the temperature of the atmosphere was + 3°, to which, as found from diagrammatic interpolation, corresponds an index-error of + 2′ 16″, that assumed for computing the altitudes.

The apparent semidiameter of the sun taken for the computation, is that determined from a comparison of the observations of the upper and lower limbs.

On this occasion, I observed with my pocket-chronometer, which, before and after the observations, was compared on board with the chief timekeeper (Reid).

Reid	19^h	4^m	$0.^s0$	0^h	55^m	$0.^s0$
Pocket-chron.	19	53	58.6	1	44	57.2
Corr. to Reid	—	49	58.6	—	49	57.2

According to the hourly meteorological observations on board, the temperature and barometric pressure were as follows: —

9 a. m. Barometer $755.^{mm}1$ Temp. $5.^\circ0$
1 p. m. — 755. 0 — 2. 6

1878. August *(August)* 19—20.

Lommechron (*Pocket-Chronometer*)	2 h′	Δ
20^h 35^m $59.^s6$	$\underline{\odot}$ 40° 50′ 0″	— 7″
37 13.0	55 40	— 1
39 18.4	41 4 55	0
44 43.2	$\overline{\odot}$ 42 31 40	+ 11
50 37.2	42 56 10	— 2
55 52.0	43 17 50	+ 1
57 20.0	43 23 45	— 1
59 43.2	43 33 15	— 4
21 6 32.0	$\underline{\odot}$ 42 57 10	+ 3
7 37.6	43 1 20	+ 3

Lommechron. (*Pocket-Chronometer*)	2 h′	Δ
0^h 29^m 55^s	$\underline{\odot}$ 47° 8′ 50″	+ 1″
33 50	$\overline{\odot}$ 48 5 5	— 7
34 40	48 3 50	— 4
35 40	$\underline{\odot}$ 46 59 10	— 5
37 28	46 56 10	+ 1
41 55	$\overline{\odot}$ 47 51 5	+ 5

Ved de mindste Kvadraters Methode har Hr. Åstrand fundet, idet der sættes $\varphi_0 = 78° 14' 48''$, $\lambda_0 = 1^h 2^m 15.^s9$, og Reids Correction til Greenwich Middeltid ved Formiddagsobservationerne $+ 16^m 0.^s0$,

By the method of the least squares, putting $\varphi_0 = 78° 14' 48''$, $\lambda_0 = 1^h 2^m 15.^s9$, and the Reid correction to Greenwich mean time for the a. m. observations $= + 16^m 0.^s0$, Mr. Åstrand found

$$\delta = \pm 3.''3$$
$$\Delta\varphi = + 0.''4 \pm 1.''1, \quad \Delta\lambda = + 0.''3 \pm 7.''8 = + 0.^s02 \pm 0.^s52.$$

En sandsynlig constant Fejl af 10″ i alle Højder bevirker en Fejl af 11.″6 i den beregnede Bredde og af 0.ˢ90 i den beregnede Længde. Resultatet bliver saaledes

$$\varphi = 78^\circ\ 14'\ 48.''4 \pm 11.''6$$
$$\lambda = 15^\circ\ 33'\ 58.''5 \pm 16.\ 7 = 1^h\ 2^m\ 15.^s9 \pm 1.^s11$$

I Kgl. Svenska Vetenskaps-Akademiens Handlingar, 13de Bind No. 9, findes en Afhandling af Dr. Aug. Wijkander: "Astronomiska Observationer under den Svenska Arktiska Expeditionen 1872—73. I. Tids- och Orts-Bestämningar." I Fortegnelsen over Bredder og Længder findes her, Side 54, ogsaa Punkter ved Advent Baj, nemlig "Rysstugen" og "Mynningen af elfven", begge bestemte efter Observationer af Prof. Nordenskiöld.

Ved Hjelp af det af Capt. Wille tegnede Kart over Advent Baj kan jeg med Lethed reducere mine Bestemmelser for Odden til de to nævnte Punkter. Jeg finder

	Br.	L.
"Odden"	78° 14′ 48.″4	1ʰ 2ᵐ 15.ˢ92
Red. til "Russestuen"	— 1. 9	— 2. 31
Russestuen	78 14 46. 5	1 2 13. 61
do. efter Svenskerne	78 15 2.	1 2 31. 5
Forskjel	— 15.″5	— 17.ˢ 9.
Red. t. "Mund. af Elven"	29.″5	— 2.ˢ85
Mund. af Elven	78° 14′ 18. 9	1ʰ 2ᵐ 13. 07
do. efter Sv. Exp.	78 14 11.	1 2 31. 0
Forskjel	+ 7.″9	— 17.ˢ 9

Medens Bredderne stemme, i Middel, indenfor den af den sandsynlige Fejl betegnede Grændse, ere de Svenske Expeditioners Længder c. 18ˢ mere østlige end mine. Da Længden af Punkterne ved Advent Bay af Svenskerne er henført til Længden af Sabine's Observatorium paa Indre Norskøen, og der — som af Dr. Wijkander i nævnte Afhandling Side 48—49 fremhævet, — er flere Grunde tilstede, der gjøre det sandsynligt, at Sabine's Længde er for stor østlig, 16 til 30 Tidssecunder, saa tør jeg anse den af mig fundne Længde for Advent Baj for at være nær den rigtige, og de 18 Tidssecunders Forskjel fra de Svenske Expeditioners som Correction til Sabines Længde af Observatoriet paa Indre Norskøen.

A probable constant error of 10″ in all the altitudes, will entail an error of 11.″6 in the computed latitudes and of 0.ˢ90 in the computed longitude. The result is thus —

$$\varphi = 78^\circ\ 14'\ 48.''4 \pm 11.''6$$
$$\lambda = 15^\circ\ 33'\ 58.''5 \pm 16.''7 = 1^h\ 2^m\ 15.^s9 \pm 1.^s11$$

In Kgl. Svenska Vetenskaps-Akademiens Handlingar, Vol. 13, No. 9, Dr. Aug. Wijkander has furnished a paper entitled "Astronomiska Observationer under den Svenska Arktiska Expeditionen 1872—1873. I. Tids- och Orts-Bestämningar." The List of Latitudes and Longitudes, p. 54, includes those of two points at Advent Bay, viz. "Rysstugen" and "Mynningen of elfven," both determined from the observations of Professor Nordenskiöld.

By referring to Capt. Wille's map of Advent Bay, I could easily reduce my determinations for the tongue of land to those of the Swedish observer for the two points. The results were as follows: —

	Lat	Long.
Tongue of land	78° 14′ 48.′4	1ʰ 2ᵐ 15.ˢ92
Red. to "Russian Hut" —	— 1.9 —	— 2. 31
Russian Hut	78 14 46.5	1 2 13.61
Do. Swed. Observ.	78 15 2	1 2 31.5
Difference	— 15.″5	— 17.ˢ 9
Red. to "Mouth of River"	29.″5	2.ˢ85
Mouth of River	78° 14′ 18.″9	1ʰ 2ᵐ 13.ˢ07
Do. Swed. Observ.	78 14 11	1 2 31.0
Difference	+ 7.″9	— 17.ˢ 9

Whilst the mean of the latitudes agrees within the limits of the probable error, the longitudes determined on the Swedish Expeditions are about 18ˢ farther east than mine. The longitude of the points at Advent Bay being referred by the Swedish observers to the longitude of Sabine's Observatory on "Inner Norway Island," and several reasons — as adduced by Dr. Wijkander in the abovementioned paper, pp. 48, 49, — rendering it highly probable that Sabine's longitude is too far east, — from 16 to 30 seconds in time, — I may regard my longitude for Advent Bay as very nearly correct, and the 18 seconds in time by which it differs from that determined on the Swedish Expeditions, as a correction for Sabine's longitude of the Observatory on Inner Norway Island.

9. Jan Mayen.

Den 30te Juli 1877, om Eftermiddagen, da "Vøringen" befandt sig i Mary Muss Bugten paa Vestsiden af Jan Mayen, brød i korte Stunder Solen igjennem Taagen, og der observeredes to Solhøjder, netop som vi lettede fra Ankerpladsen.

9. Jan Mayen.

In the afternoon of the 30th of July, 1877, — the "Vøringen" lying at anchor in Mary Muss Bay on the west coast of Jan Mayen, — the sun broke at intervals through the mist, and two solar altitudes were taken, just as we were getting under weigh.

Den følgende Dag, den 31te Juli, laa Expeditionen til Ankers i den store Rækved-Bugt paa Jan Mayens Østside. Da Søgangen hindrede os fra at komme i Land, toges fra Skibsborde en Række Solhøjder, med forskjellige Sextanter, dels af Capt. Wille, dels af mig. Omstændighederne vare ikke gunstige. Skyer og Taage tog jevnlig Solen eller Horizonten bort.

Den 1ste August var Vejret noget gunstigere, og der observeredes om Formiddagen en Del Solhøjder fra samme Ankerplads, førend vi lettede.

I den nedenstaaende Tabel betegner G Capt. Grieg og M Mohn; E betegner den Expeditionen tilhørende Sextant og S en Skibet tilhørende Sextant.

Hver Iagttager bestemte sin Indexfejl. Jeg fandt den for Troughtons Sextant den 31te Juli ved Solen + 1′ 38″ og ved Horizonten + 1′ 35″. Benyttet er den første Værdi.

De fleste Observationer gjordes fra Hyttedækket. Øjets Højde regnedes her til 18 norske Fod eller 5.6 Meter.

I Beregningen er benyttet Solradien efter Nautical Almanac. Som det vil sees nedenfor, er den af Observationerne udledede Solradius større.

Som Observationsuhr benyttedes dels Lommechronometer, dels Lommeuhre, der umiddelbart før eller efter hver Observationsrække sammenlignedes med Hovedchronometret Reid. Hr. Tornøe, vor Chemiker, assisterede mig ved flere Observationer, idet han noterede Uhret. Reids Correction til Greenwich Middeltid beregnedes for Observationerne

	Juli 30	Juli 31	Aug. 1
til	$+ 8^m 28.^s6$	$+ 8^m 29.^s2$	$+ 8^m 30.^s2$

Efter foreløbige Beregninger sattes for Ankerpladsen paa Østsiden $\varphi_0 = 70^\circ 58.'0$ og $\lambda_0 = 0^h 33^m 48.^s3$ W. Greenwich.

Beliggenheden af Ankerpladsen paa Vestsiden er ret nøje bestemt trigonometrisk i Forhold til Ankerpladsen paa Østsiden. Ved Hjelp af Stormastens Højde, 18.6 Meter, der fra en Baad af Capt. Wille maaltes i Vinkel til 4° 20.′3, fandtes Baadens Afstand fra Skibet = 245 Meter. Fra Baaden og fra Skibet (Mohn) sigtedes samtidig til Toppen af "Fugleberget", en fremtrædende let kjendelig Fjeldtop paa Øens Vestside ved Mary Muss Bugten. Vinkelen Fugleberg—Skib, seet fra Baad, var 86° 3.′7, Vinkelen Fugleberg—Baad, seet fra Skibet, var 90° 13.′3, hvoraf beregnes Afstanden fra Skibet til Fugleberget til 2.′03. Fuglebergets Azimuth fra Skibet fandtes efter 3 Compas-Pejlinger paa 3 forskjellige Kurser = N. 25° W. Derefter ligger Fugleberget 1′ 50.″4 nordligere og 2′ 38.″0 vestligere end Ankerpladsen paa Østsiden. Fra Fuglebergets Fod maalte jeg den 29de Juli Masthøjden til 0° 55.′5, hvilket giver en Afstand af 0.′62. Skibets Azimuth fra Fugleberget var her omtrent 70°. Heraf beregnes, at

The following day, July 31st, the Expedition anchored in Great Wood Bay, on the east coast of the island. The swell preventing us from landing, Capt. Wille and myself took a series of solar altitudes on board, with different sextants. The atmospheric conditions were not favourable, cloud and mist repeatedly blotting out the sun or the horizon.

On the 1st of August the weather cleared a little, and in the forenoon a few solar altitudes were observed from the same anchorage, shortly before we got under weigh.

In the Table given below, G signifies Capt. Grieg, and M, Professor Mohn; E signifies the sextant belonging to the Expedition, and S a sextant belonging to the vessel.

Each observer determined his index-error. For the Troughton sextant, I found the index-error, on the 31st of July, to be + 1′ 38″ by the sun, and + 1′ 35″ by the horizon. The first of these values was applied.

Most of the observations were made from the deck of the roundhouse, where the eye of the observer was assumed to be 18 Norwegian feet, or 5.6 metres, above the sea-level.

For these computations, the sun's semidiameter was taken from the Nautical Almanac. As will appear in the sequel, that deduced from the observations was somewhat greater.

We observed with the pocket-chronometer and ordinary watches, each timepiece being compared, immediately before and after a series of observations, with our chief chronometer, the Reid. Mr. Tornøe, chemist to the Expedition, assisted me in several of the observations, by noting the indications of the watch. The Reid correction to Greenwich mean time was computed for the observations taken —

	July 30	July 31	Aug 1
at	$+ 8^m 28.^s6$	$+ 8^m 29.^s2$	$+ 8^m 30.^s2$

For the anchorage on the east coast of the island, I put, as the result of preliminary computations, $\varphi_0 = 70^\circ 58.'0$ and $\lambda_0 = 0^h 33^m 48.^s3$ W. Greenwich.

The position of the anchorage off the west coast of the island relative to that of the anchorage on the east side, was determined trigonometrically with tolerable exactness. Taking the height of the mainmast, 18.6 metres, which, as measured from a boat by Capt. Wille, gave an angle of 4° 20.′3, the distance of the boat from the ship was found to be 245 metres. From the boat and from the ship (Prof. Mohn), we simultaneously observed the summit of the "Fugleberg" (bird-cliff), a conspicuous mountain-top on the west side of the island, in close proximity to Mary Muss Bay. The angle Fugleberg—ship, as determined from the boat, was 86° 3.′7; the angle Fugleberg—boat, as determined from the ship, 90° 13.′3; and with these results the distance from the ship to Fugleberg was computed at 2.′03. The azimuth of Fugleberg from the ship, we found from 3 compass-bearings on 3 different courses = N. 25° W. The Fugleberg should accordingly lie 1′ 50.″4 farther north and 2′ 38.″0 farther west than our

Ankerpladsen paa Vestsiden ligger 10.″9 nordligere og 1′ 49.″1 vestligere end Fugleberget. Ankerpladsen paa Vestsiden ligger altsaa 2′ 1.″3 nordligere og 4′ 27″ vestligere end Ankerpladsen paa Østsiden. Er for den sidste $\varphi_0 = 70^\circ\, 58.'0$ og $\lambda_0 = 0^h\, 33^m\, 48.^s3$, saa bliver for Ankerpladsen paa Vestsiden $\varphi_0 = 71^\circ\, 0'\, 1''$ og $\lambda_0 = 0^h\, 34^m\, 6.^s1$.

Efter de mindste Kvadraters Methode beregnede jeg de sandsynligste Correctioner til φ_0 og λ_0.

Naar jeg derefter grupperede Differentserne (hvis Kvadratsum er Minimum) mellem de observerede (reducerede) Højder af Solcentret og de efter de fundne sandsynligste Værdier for Bredden og Længden beregnede, efter de observerede Solrender, viste det sig, at Middeldifferentsen for øvre Rand var $+\, 0.'295$ og for nedre Rand $-\, 0.'282$. Den observerede Solradius er saaledes gjennemsnitlig 0.′3 større end den til Beregningen benyttede. Corrigeres med denne Størrelse, faaes de i den følgende Tabel anførte Værdier af Differentserne Δ mellem observeret minus beregnet Solhøjde. I Tabellen ere alle Uhrtider reducerede til Reid, og alle maalte Solhøjder corrigerede for Indexfejl, Kimmingdaling, Refraction, Parallaxe og Solradius (Naut. Almanac's). *o* betegner øvre Solrand, *n* nedre Solrand. Aflæsningerne paa Sextanten ere gjorte i Secunder og Reductionen udført med Secunder, men da den sandsynlige Fejl af en enkelt Højde er over et halvt Minut, opføres i Tabellen Tiendedels Minut, ligesom Beregningen efter de mindste Kvadraters Methode er ført med femzifrede Logarithmer.

anchorage off the east coast. From the foot of the Fugleberg, the height of the mast, as measured by myself on the 29th of July, gave an angle of $0^\circ\, 55.'5$, which corresponds to a distance of 0.′62. At this point, the azimuth of the ship from the Fugleberg was about 70°. Computing with these results, our anchorage off the west coast should lie 10.″9 farther north and 1′ 49.″1 farther west than the Fugleberg. Hence, the anchorage off the west coast lies 2′ 1.″3 farther north and 4′ 27″ farther west than the anchorage off the east coast. Assuming for the latter $\varphi_0 = 70^\circ\, 58.'0$ and $\lambda_0 = 0^h\, 33^m\, 48.^s3$, for the anchorage off the west coast $\varphi_0 = 71^\circ\, 0'\, 1''$ and $\lambda_0 = 0^h\, 34^m\, 6.^s1$.

By the method of the least squares, I computed the most probable corrections of φ_0 and λ_0.

Then, on grouping the differences (the sum of the squares of which is a minimum) between the observed (duly corrected) altitudes of the sun's centre and those computed with the most probable values found for latitude and longitude, according to the observed solar limbs, the mean difference for the upper limb proved to be $+\, 0.'295$, and for the lower $-\, 0.'282$. On an average, therefore, the observed semidiameter of the sun is 0.′3 greater than that taken for the computation. Corrected with this quantity, we get the values given in the following Table for the differences, Δ, between the observed and the computed solar altitudes. In this Table all chronometer-times are reduced to those of the Reid chronometer, and all observed altitudes corrected for the index-error, the dip of the horizon, refraction, parallax, and the sun's semidiameter (from Naut. Almanac); *o* signifies upper solar limb, *n* lower solar limb. The readings of the sextant were noted in seconds, and their reduction computed in seconds; but the probable error of a single altitude amounting to more than half a minute, tenths of a minute have been given in the Table. The computation by the method of the least squares is made with five decimals in the logarithms.

Ankerplads paa Vestsiden. 1877. Juli 30.

(Anchorage on the West Side. 1877. July 30.)

Chron. Reid.	Obs. Højde. (*Obs. Altitude.*)	Rand. (*Limb.*)	Sext.	Obs.	Δ
$5^h\ 47^m\ 28^s$	$20^\circ\ 57.'2$	*n.*	*E.*	*G.*	$+\ 0.'9$
5 48 1	20 56.4	*n.*	*S.*	*M.*	$-\ 1.3$

Ankerplads paa Østsiden. Obs. Capt. Wille.

(Anchorage on the East Side.)

Chron. Reid.				Obs. Højde. (Obs. Altitude.)		Rand. (Limb.)	Sext.	Δ
Juli *(July)* 31.	0^h	38^m	$59.^s$	37°	$11.'2$	*n.*	*S.*	— 1.'1
	0	59	18.5	37	2.4	*n.*	*S.*	— 0.4
	1	11	56	36	51.6	*n.*	*E.*	— 0.1
	1	28	42.5	36	30.3	*n.*	*E.*	— 0.7
	22	42	17	34	32.2	*n.*	*E.*	— 2.1

De 4 første er givet dobbelt Vægt, da de bero paa flere Observationer hver. Man ser, at den observerede Solradius er større end min, sandsynligvis paa Grund af, at der er benyttet svagere Blændglas.

To the first 4 altitudes is attached double weight, each being the mean of several observations. The observed semidiameter of the sun is greater than mine, probably from lighter coloured glasses having been used.

Ankerplads paa Østsiden. Troughton's Sextant.

(Anchorage on the East Side.)

Iagttager *(Observer)*: Mohn. 1877. Juli *(July)* 30—31.

Chron. Reid.			Rand. (Limb.)	Obs. Højde. (Obs. Altitude.)		Δ
22^h	35^m	$37.'9$	*n.*	34°	$31.'4$	+ 0.'6
	37	58.6	*n.*		37.4	+ 0.4
0	22	54.0	*n.*	37	11.5	— 1.0
	37	37.5	*o.*		14.9	+ 1.7
	40	18.3	*n.*		11.3	— 0.8
	42	39.0	*n.*		11.0	— 0.5
	48	25.5	*o.*		10.4	+ 0.4
	58	39.6	*n.*		4.0	+ 0.5
1	0	19.5	*o.*		2.7	— 0.1
	13	18.0	*n.*	36	49.1	— 1.4
	15	9.9	*o.*		50.0	— 1.2
	19	23.6	*o.*		46.0	+ 1.9
	20	57.4	*n.*		41.9	+ 0.4
	22	11.2	*n.*		39.3	— 0.6
	23	41.1	*o.*		38.5	— 0.1
	25	5.0	*o.*		36.7	— 0.1
	26	23.0	*n.*		34.5	+ 0.1
	27	31.9	*n.*		32.7	0.0
	29	18.7	*o.*		30.4	— 0.4
	29	44.6	*o.*		28.2	— 2.0
	32	36.5	*o.*		26.4	+ 0.6

Chron. Reid.			Rand. (Limb.)	Obs. Højde. (Obs. Altitude.)		Δ
1^h	33^m	$58.'3$	*n.*	36°	$22.'4$	— 0.'7
	46	23.3	*o.*		2.2	— 0.1
	47	23.2	*o.*		0.2	— 0.3
	48	37.0	*o.*	35	58.7	+ 0.6
	49	21.0	*o.*		56.3	— 0.5
	49	55.0	*o.*		55.3	— 0.3
	50	39.0	*o.*		54.0	— 0.3
	51	20.4	*o.*		53.9	+ 1.3
	52	32.8	*n.*		50.1	+ 0.4
	53	29.2	*n.*		47.9	+ 0.1
	54	22.1	*n.*		46.4	+ 0.2
	55	7.6	*n.*		45.3	+ 0.7
	56	47.5	*n.*		41.9	+ 0.7
	58	35.4	*n.*		37.6	+ 0.3
2	0	29.7	*n.*		35.4	+ 2.1
22	41	38.0	*o.*	34	33.2	+ 0.5
	43	57.5	*o.*		39.0	+ 0.4
	48	13.0	*o.*		49.6	+ 0.5
23	19	19.6	*n.*	35	54.9	+ 0.6
	22	34.0	*n.*		59.2	— 0.8
	23	59.8	*n.*	36	2.9	+ 0.4

Af alle Observationer findes $\delta = \pm 0.'57 = \pm 34''$.

$\Delta\varphi = + 0.'07 \pm 0.'09 = + 4.''5 \pm 5.''5$.
$\Delta\lambda = - 2.'35 \pm 0.'66 = - 2'\ 20.''9 \pm 39.''8 = - 9.^s39 \pm 2.^s65$.

All the observations taken together give $\delta = \pm 0.'57 = \pm 34''$.

$\Delta\varphi = + 0.'07 \pm 0.'09 = + 4.''5 \pm 5.''5$.
$\Delta\lambda = \quad 2.'35 \pm 0.'66 = - 2'\ 20.''9 \pm 39.''8 = - 9.^s39 \pm 2.^s65$.

C. Wille. Magnetiske Observationer.

Efter den for Nordhavs-Expeditionen lagte Plan skulde der søges udført Observationer til Bestemmelse af Jordmagnetismens Elementer saavel i Land som i Søen. Til dette Øjemed anskaffedes og medbragtes følgende Instrumenter:

Et Unifilar-Magnetometer, No. 38, af Elliott Brothers i London. Instrumentet blev verificeret og dets Konstanter bestemte ved Observatoriet i Kew.

En liden Theodolit af Olsen i Kristiania, laant af den geografiske Opmaaling.

Et Inklinatorium af John Dover, Charlton, Kent, undersøgt i Kew.

Et Admiralitets-Standard-Kompas, verificeret ved Kompas-Observatoriet i Deptford.

Flere Azimuth-Kompasser.

En Fox-Cirkel No. 30 af John Dover, med Hjælpeapparater og Slingrebord.

Flere Kronometre og Sextanter.

Et Observationstelt fra Bergens Arsenal, velvillig udlaant af Armé-Intendanten.

Jeg skal nu særskilt behandle Observationerne paa Landstationer og Observationerne i Søen.

A. Observationer paa Land-Stationer og deres Resultater.

a. Deklination.

Begge til Magnetometret hørende Magneter var Kollimations-Magneter, med Skalaer i Objectivglassets Brændplan. Da Instrumentet ikke var forsynet med Plan-Spejl til Deklinationsbestemmelse, men kun havde et Hulspejl til at

C. Wille. Magnetical Observations.

The Scheme of Work approved for the Norwegian North-Atlantic Expedition, was, if possible, to comprise observations for determining the elements of terrestrial magnetism, alike on shore and at sea. With this object in view, the following instruments were provided.

A Unifilar Magnetometer, No. 38, made by Elliott Brothers, of London. This instrument was verified, and had its constants determined, at the Kew Observatory.

A small Theodolite, by Olsen of Christiania, obtained on loan from the Geographical Survey.

A Dip-Circle, by John Dover, of Charlton, Kent, examined at Kew.

An Admiralty Standard-Compass, verified at the Compass Observatory, Deptford.

Several Azimuth-Compasses.

A Fox-Circle, No. 30, by John Dover, with auxiliary apparatus and gimbal-table.

Several Chronometers and Sextants.

A Tent, kindly lent from the Bergen Arsenal.

I will now pass on to the observations, describing separately those taken at the land-stations and those made at sea.

A. Observations at Land-Stations, and their Results.

a. Declination.

Both of the magnets belonging to the magnetometer were collimator-magnets, with the scale in the focal plane of the object-glass. The instrument not being provided with a plane mirror for observing the declination, but

belyse Magnetens Skala, maatte en særskilt Theodolit anvendes til Bestemmelse af Azimut. Theodoliten opstilledes i 1876 paa sit eget Stativ med sin Kikkert i samme Højde som Magneten og saa nær denne som muligt. Da dette voldte meget Bryderi, lod jeg forfærdige paa Hortens mekaniske Verksted et Underlag af Messing, der kunde lægges paa Magnetometret og fæstes til dette ved Hjælp af de samme Indretninger, som anvendtes ved Deflektionsstangens Befæstigelse. Paa den ene Side af dette Underlag anbragtes Theodoliten, med Fodskruerne i smaa dertil afpassede Huller, og paa den anden Side en Modvægt af Bly. Det var med denne Indretning altid let at faa se og kunne indstille Magnetskalaens Midtstreg paa Theodolitens Vertikalfilament. Observationerne udførtes i Regelen paa følgende Maade:

Ophængningstraadens Torsion ophævedes. Theodoliten nivelleredes, og indstilledes med Filamentet paa Skalaens Midtstreg i Magneten, hvorefter Theodolitens Nonier aflæstes (Magn. I).

Theodoliten drejedes, saaledes at dens Kikkert pegede lidt vestenfor Solen, i Solcentrets Højde, og fastklemtes. Tidspunkterne for Overgangen af forangaaende og efterfølgende Rand af Solen over Vertikalfilamentet noteredes efter Kronometer. Denne Iagttagelse gjordes enten med Blændglas foran Okularet eller ved at projicere Solens og Filamentets Billede paa en hvid Skjærm. I mange Tilfælde var der to Iagttagere, af hvilke den ene observerede Solrandenes Passage og raabte "Nu" i det Øjeblik, de tangerede Filamentet, medens den anden observerede og noterede tilsvarende Øjeblikke efter Kronometret. Nonierne aflæstes.

Kikkerten lagdes om gjennem Zenit (Nadir), drejedes 180° om Vertikalaxen og begge Solrandes Passage observeredes i denne Stilling efter Kronometret, ligesom Nonierne aflæstes.

Magneten omlagdes, idet den drejedes 180° om sin Længdeaxe, og Filamentet i Theodolitkikkerten indstilledes atter paa Magnetskalaens Midtstreg, og Nonierne aflæstes. (Magn. II).

Naar Omstændighederne tillod det, observeredes atter Magneten i Stillingen I. Stundom blev den omlagt flere Gange.

Ligesaa flyttedes, ved saadanne Lejligheder, Theodoliten ved den følgende Sats saaledes, at Fodskruerne kom hver i andre Huller, hvorved dens Cirkels Nulpunkt forandredes 120°. Det viste sig imidlertid, at dens Delingsfejl ikke var saa betydelige, at denne Vexling af Stilling var nødvendig for at opnaa den forlangte Nøjagtighed af c. 1 Minut.

I flere Tilfælde bestemtes Azimut af en Mire, til hvilken Observationen af Magneten i begge Stillinger blev knyttet.

Kronometrets Stand blev i de fleste Tilfælde bestemt ved Solhøjder tagne med Sextant paa Observations-

having only a concave mirror by which to illuminate the scale of the magnet, the azimuth had to be determined with a separate theodolite. In 1876, the theodolite was mounted on its own stand, with the telescope facing the magnet, and as near it as possible. This, however, proving excessively troublesome, I procured from the Horten Mechanical Works a brass support, which, when placed upon the magnetometer, could be attached in the manner adopted for fixing the deflection-rod. On one side of this brass support was mounted the theodolite, with the foot-screws fitting into holes made for the purpose, the other side being given a counterpoise of lead. With this arrangement, the scale of the magnet could be easily sighted, and the middle division bisected by the vertical wire of the theodolite. The observations were generally taken as follows: —

The torsion of the suspension thread having been first removed, the theodolite was levelled, and the wire made to bisect the middle division of the scale of the magnet, after which the verniers of the theodolite were read off (Magn. I). The theodolite was then moved in azimuth and altitude till its teloscope pointed a little to the west of the sun, at the altitude of the sun's centre, and clamped in that position. The times for the transit of the preceding and following limbs of the sun across the vertical wire, were noted by a chronometer. This observation was taken either with a coloured glass before the eye-piece or by projecting the image of the sun and the wire on a white screen. Frequently, there were two observers, in which case one observed the transit of the solar limbs, calling out at the moment they were tangent to the wire, while the other observed and noted the corresponding readings of the chronometer. Then, after reading off the verniers, the telescope was turned through the zenith (nadir), moved 180° on its vertical axis, and the transits of both solar limbs observed in that position by the chronometer, the verniers being also read off.

The magnet was now inverted, being turned 180° about its longitudinal axis, and the wire of the telescope of the theodolite again made to bisect the middle division of the scale of the magnet, after which the verniers were read off (Magn. II).

Circumstances permitting, the magnet was again observed in position I. Occasionally, it was inverted several times.

Moreover, on such occasions the theodolite was so moved previous to the following set of observations, that the foot-screws should correspond with different holes, and change the zero of its circle by 120°. Its errors of division, however, did not prove so considerable as to render imperative such change in position for attaining the desired accuracy of about one minute.

In several cases, the azimuth of a mark was determined from the observations of the sun, and the observations of the magnet, in both positions, connected with the direct observations of the mark.

As a rule, the error of the chronometer was found from solar altitudes, taken with the sextant at the place

stedet. Herom kan jeg henvise til den foranstaaende Afhandling af Professor Mohn. Kronometrenes Gang bestemtes efter Sammenligning med det ombord værende Normalkronometer, hvis Stand og Gang var bestemt væsentlig efter telegrafiske Tidssignaler fra Christiania Observatorium[1]. Paa et Par Steder toges Kronometrets Stand efter dets Stand for Greenwich Tid og Længden af Observationsstedet efter Kystkartet.

Observationerne af alle Elementer gjordes i Teltet. Ved Observation af Solen aabnedes Teltet netop saavidt i Rum og Tid, som var nødvendigt.

of observation. For details on this head, I can refer to the foregoing Memoir, by Professor Mohn. The rate of the chronometer was determined by comparison with the standard chronometer on board, the error and rate of which were found chiefly by means of the time-signals telegraphed from the Christiania Observatory[1]. At one or two points, the error of the chronometer was taken from its error on Greenwich time and the longitude of the place of observation on the coastal chart.

The observations of all the elements were made in the tent. For observations of the sun, the tent was opened to just the necessary extent in space and time.

b. Horizontal Intensitet.

Observationerne og Beregningerne udførtes efter Instruktionerne i "A Manual of Scientific Enquiry"; Fourth Edition, 1871 Side 96 til 101. Unifilar-Magnetometrets Konstanter var ved Kew-Observatoriet bestemte saaledes:

Correction for Delingsfejl ved Afbøjningsstangen
ved 1 Foot. = + 0.00002 Foot. } ved 62° F.
„ 1.5 — = + 0.00004 — }

Svinge-Magnet, Værdi af 1 Skaladel = 1.′9.

Afbøjningsmagnetens Correction til 35° F = $0.000130\ (t_0 - 35) + 0.00000056\ (t_0 - 35)^2$.

Induktionskoefficient $\mu = 0.000195$.

Log π^2 K ved 60° F = 1.69708.

Der er desuden givet forskjellige Hjælpetabeller, blandt hvilke en for Værdierne af Log. π^2 K og Log $^1/_2$ r^3 for forskjellige Temperaturer:

b. Horizontal Intensity.

The observations and computations were made in accordance with the instructions contained in "A Manual of Scientific Enquiry;" Fourth Edition, 1871, pp. 96—101. The constants of the Unifilar Magnetometer had been determined at the Kew Observatory, as follows: —

Correction for errors of division of Deflecting Rod
at 1 Foot = + 0.00002 foot } at 62° F.
„ 1.5 — = + 0.00004 „ }

Vibration Magnet, value of 1 division of Scale = 1.′9.

Deflecting Magnet, correction to 35° F. = $0.000130\ (t_0 - 35) + 0.00000056\ (t_0 - 35)^2$.

Coefficient of Induction $\mu = 0.000195$.

Log π^2 K at 60° F = 1.69708.

Moreover, divers auxiliary Tables are annexed, one of which gives the values of Log. π^2 K and of Log. $^1/_2$ r^3 at different temperatures.

Temp. F	Log. π^2 K	Log. $\frac{1}{2}$ r^3 $r_0 = 1.0$	Log. $\frac{1}{2}$ r^3 $r_0' = 1.3$
30	1.69690	9.69859	0.04041
40	696	872	054
50	702	885	067
60	708	898	080
70	714	911	093
80	720	924	106
90	1.69726	9.69937	0.04119

Som Exempel paa Observationernes Udførelse og Beregning hidsættes følgende, efter de fra Kew erholdte trykte Blanketter udfyldte, Skemata.

To show the mode of taking and computing the observations, copies of the printed forms in use at Kew Observatory have been filled out, and here subjoined.

[1] Se den citerede Afh. Side 2.

[1] See Professor Mohn's Memoir, p. 2.

Observations of Deflection, 2nd of October 1876.

Station Christiania; Lat. 59° 54′ 43″, Long. 10° 43′ 37″.
Mean Time at Station; commencing $0^h\ 36^m$ p. m., ending $1^h\ 20^m$ p. m.
Magnet (A) deflecting; (B) suspended.

Deflecting Magnet: Distance	N. End.	Temp.	Readings of Verniers	Mean of Verniers	Corrected Circle Reading	Means and Differences	
East							
1 Foot	E.	53.°4	143° 17′ 40″	143° 17′ 30″	143° 17′ 30″	143° 13′ 40″	
			17 20		143 9 50	90 23 40	
1 "	W.	53. 4	90 21 0	90 21 10		52 50 0	Diff.
			21 20		90 21 10		
1.3 "	E.	53. 3	128 13 20	128 13 20	26 10	26 25 0	u_0
			13 20				
1.3 "	W.	53. 2	105 7 40	105 7 50			
			8 0				
West							
1 Foot	W.	53.°4	90° 26′ 0″	90° 26′ 10″	128° 13′ 20″	128° 17′ 45″	
			26 20		22 10	105 10 25	
1 "	E.	53. 4	143 9 40	143 9 50		23 7 20	Diff.
			10 0		105 7 50		
1.3 "	W.	53. 0	105 13 0	105 13 0	13 0	11 33 40	u'_0
			13 0				
1.3 "	E.	53. 0	128 22 0	128 22 10			
			22 20				

Mean $t_0 = \begin{array}{r} 53° \ 26 \\ -\ \ 8 \\ \hline 52.°5 \end{array}$ Observed Angles of Deflection $(u_{,0})$ $\begin{array}{l} r_0 = 1.0 = 26° \ 25' \ 0'' \\ r'_0 = 1.3 = 11 \ \ 33 \ \ 40 \end{array}$

$$\frac{m_0}{X_0} = \tfrac{1}{2} r^3 \sin u_0; \qquad \frac{m'}{X'} = \frac{m_0}{X_0}\left\{1 + \frac{2\mu}{r_0^3} + q\,(t_0 - t)\right\}; \qquad \frac{m}{X} = \frac{m'}{X'}\left(1 - \frac{P}{r_0^2}\right).$$

$r = 1.0 \quad r' = 1.3 \qquad\qquad r' = 1.3$

			$\tfrac{1}{2} r^3$ Log. =	9.69888	0.04070
$1 + \frac{2\mu}{r_0^3} =$	1.00039	1.00086	Sin. u_0 Log. =	9.64826	9.30193
$+ (t_0 - t)\,q =$	0.00244	0.00244	$\frac{m_0}{X_0}$ Log. =	9.34714	9.34263
$1 + \frac{2\mu}{r_0^3}(t_0 - t)\,q =$	1.00283	1 00330	Log. =	0.00123	0.00143
			$\frac{m'}{X'}$ Log. =	9.34837	9.34406
$1 - \frac{P}{r_0^2} = 0.97618$			Log. =	9.98953	9.99384
			$\frac{m}{X}$ Log. =	9.33790	9.33790
			mX Log. =	0.41767	
$\therefore\ mX - \frac{m}{X} = X^2$			Log. =	1.07977	
$3.4664 = X =$			Log. =	0.53988	
$0.7547 = m =$			Log. =	9.87779	
Red. to Metr. Un.			Log. =	9.66378	
$1.5983 = X =$			Log. =	0.20366	

Observer *Carl Wille.*

Observations of Vibration, 2nd of October 1876.

Station Christiania; Lat. 59° 54′ 43″, Long. 10° 43′ 37″.
Chronometer. Error at Station = $0^h\ 42^m\ 38^s$ Daily Rate (s) = 4.'5 Accl.
Magnet (A) suspended.
Effect of 90° of Torsion = 2.26 Div. = 4.'29. One Div. of Scale = 1.'9.

	Mean Time at Station	Semiarc of Vib.	Temp. of Magnet	
At Commencement	$1^h\ 50^m$ p. m.	76′	55.°0	$t_\circ$ = 55.°0
At End	2 2	22.8		$t_\circ$ = 55. 0

Scale moving apparently to the Right					Scale moving apparently to the Left				
No. of Vib.	Time of Centre passing wire	No. of Vib.	Time of Centre passing wire	Time of 100 Vib.	No. of Vib.	Time of Centre passing wire	No. of Vib.	Time of Centre passing wire	Time of 100 Vib.
0	$2^h\ 33^m$ 21.'7	100	40^m 38.'1	7^m 16.'4	5	$2^h\ 33^m$ 43.'5	105	41^m 00.'0	7^m 16.'5
10	34 5.3	110	41 21.7	16.4	15	36 27.1	115	41 43.5	16.4
20	34 49.0	120	42 5.5	16.5	25	35 10.7	125	42 27.1	16.4
30	35 32.7	130	42 49.2	16.5	35	35 54.5	135	43 11.0	16.5
40	36 16.3	140	43 33.0	16.7	45	36 38.0	145	43 54.5	16.5
50	37 0.0	150	44 16.5	16.5	55	37 21.7	155	44 38.3	16.6
Diff.	3 38.3			30	Diff.	3 38.2			29
100 at	2 40 38.3		Mean (1) =	7 16.5	105 at	40 59.9		Mean (2) =	7 16.48

$$T_{,} = T_{\circ}\left\{1 - \frac{s}{86400} - \frac{\alpha\alpha'}{16}\right\}. \quad T^2 = T_{,}^2\left\{1 + \frac{H}{F} - q\,(t_\circ - t) + \mu\,\frac{X_\circ}{m_\circ}\right\}. \quad mX = \frac{\pi^2 K}{T^2}.$$

$1 - \frac{s}{86400}$ = 0.99995 — Mean (1) = 7^m 16.50
$- \frac{\alpha\alpha'}{16}$ = 0.00001 — „ (2) = 7 16.48
$T_\circ$ = 4.'3649 — Log. = 0.63997

$1 - \frac{s}{86400} - \frac{\alpha\alpha'}{16}$ = 0.99994 . . . . Log. = 9.99997
$T_{,}$ Log. = 0.63994
2
$1 + \frac{H}{F}$ = 1.00079
$- q\,(t_\circ - t)$ = 0.00282 — $T_{,}^2$ Log. = 1.27988
$+ \mu \div \frac{m_\circ}{X_\circ}$ 0.99997
= 0.00088

$1 + \frac{H}{F} - q\,(t_\circ - t) + \mu - \frac{m_\circ}{X_\circ}$ = 0.99885 . . . . Log. = 9.99950
T^2 Log. = 1.27938
μ Log. = 6.29003 — $\pi^2 K$ Log. = 1.69705
$\frac{m_\circ}{X_\circ}$ Log. = 9.34714 — $mX = \frac{\pi^2 K}{T^2}$ Log. = 0.41767
$\mu \div \frac{m_\circ}{X_\circ}$ = 0 00088 Log. = 6.94289 — $\frac{m'}{X'}$ Log. = 9.34837
$mX - \frac{m'}{X'} = X'^2$ Log. = 1.06930
X' = 3.4249 Log. = 0.53465
m'^2 Log. = 9.76604
m' = 0.76387 Log. = 9.88302

Observation of Torsion.

Circle turned		Scale	Mean	Diff.
0°	=	40		
+ 180°	=	44.3	39.75	4.55
0°	=	39.5		
— 180°	=	35.5	40. 0	4.5
0°	=	40.5		4.5

90° = 2.26 = 4.'29

Observer *Carl Wille.*

c. Inklination.

Det Doverske Inklinatorium havde tre Naale. Aflæsningen af Naalespidsene sker ved Mikroskoper. Nonierne angiver Minutter. Observationerne udførtes og beregnedes efter Instruktionerne i Manual of Scientific Enquiry Side 103—105. Følgende Skema benyttedes:

c. Inclination.

Dover's Dip-Circle had three needles. The ends of the needles are observed with microscopes. The verniers read minutes. The observations were taken and computed in accordance with the instructions in "A Manual of Scientific Enquiry," pp. 103—105. The printed form was as follows:

Magnetic Dip.

Station Christiania. Date 2nd of October 1876.
Needle No. 1.
Setting of Azimuth Circle 64° 49′ + 64° 28′ = 64° 38′.
Remarks . . . . . Magnetical Pillar in the Park of the Observatory.
Time 10^h 55^m a. m. to 0^h 5^m p. m.

		Poles direct B dipping			Poles reversed A dipping		
	Face of Instr.	Readings of Needle			Readings of Needle		
		Lower end	Upper end	Mean	Lower end	Upper end	Mean
Face of Needle to face of Instrument	EAST	71° 5.′5	71° 6.′0	71° 5.′7	71° 10′	71° 12′	71° 11.′0
		4.5	5.5	5.0	9	12	10.5
		4.0	4.0	5.0	9	11	10.0
		Mean = a		71 5.2	Mean = b		71 10.5
	WEST	71 0	70 58	70 59	71 1	70 58	59.5
		0	59	59.5	1	58	
		0	71 0	60			
		Mean = a'		70 59.5	Mean = b'		70 59.5
Face of Needle reversed	WEST	71 17	71 14	71 15.5	71 21.5	71 20	71 20.7
		16	14	15	21	19	20.0
		15	13	14	20	19	19.5
		Mean = a''		71 14.8	Mean = b''		71 20.1
	EAST	71 7	71 10	71 8.5	70 41	70 43	70 42.0
		3	6	4.5	41	43	42.0
		5	8	6.5	40	43	41.5
		Mean = a'''		71 6.5	Mean = b'''		70 41.8
		a''		71 14.8	b''		71 20.1
		a'		70 59.5	b'		70 59.5
		a		71 5.2	b		71 10.5
				4 26.0			4 11.9

Mean of Means = 71° 6.′5

Mean of Means = β 71° 2.′97
Do. Do. = α 71 6.5

$\frac{\alpha + \beta}{2}$ Dip 9.47
71 4.74

Observer *Carl Wille.*

I. Bergen.

Ved Observatoriet paa Nordnes. Bredde $\varphi = 60° 23' 54''$, Længde $\lambda = 5° 24' 0''$ E. Greenwich.

Horizontal-Intensitet.

1876, Ma; 22.

Afbøjnings-Observation Kl. 12 til 1,30 Min. Eft.

Temperatur $t_0 = 62.°5$ F. Afbøjningsvinkel, for Afstanden $r_0 = 1$ Fod, $u_0 = 28° 58' 55''$. Iagttager C. Wille.

Svingnings-Observation Kl. 2,6 Min. til 2,18 Min. Eft.

Temperatur $t_0 = 65.°5$ F. Observeret Svingetid $T_0 = 4.'4919$. Kronometret vinder daglig 3'. Halve Svingebue ved Begyndelsen $\alpha = 77.'9$, ved Enden $\alpha' = 24.'7$. Torsion for en Dreining af 90°, $u = 11.'78$. Iagttager C. Wille.

Resultat. Med P = 0.02300 faaes $m = 0.76660$ og Horizontalintensitet X = 3.2238.

Inklination.

Kl. 3,0 til 4,30 Min. Eft. Naal No. 1. C. Wille.

Resultat. $\theta = 72° 24.'3$.

I. Bergen.

Observatory at Nordnes; latitude $\varphi = 60° 23' 54''$, longitude $\lambda = 5° 24' 0''$ E. Greenwich.

Horizontal Intensity.

1876, May 22.

Observation of Deflection: 12 a. m. to 1,30 p. m.

Temperature $t_0 = 62.°5$ F.; angle of deflection for the distance $r_0 = 1$ foot, $u_0 = 28° 58' 55''$. Observer C. Wille.

Observation of Vibration: 2,6 p. m. to 2,18 p. m.

Temperature $t_0 = 65.°5$ F.; observed time of one vibration $T_0 = 4.'4919$; chronometer gaining daily 3'. Semiarc of vibration at commencement $\alpha = 77.'9$, at end $\alpha' = 24.'7$. Torsion for a twist of 90°, $u = 11.'78$. Observer C. Wille.

Result. — With P = 0.02300, m will be = 0.76660 and the horizontal intensity X = 3.2238.

Inclination.

3,0 p. m. to 4,30 p. m. Needle No. 1. Observer C. Wille.

Result. — $\theta = 72° 24.'3$.

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2. Husø.

$\varphi = 60° 59.'6$; $\lambda = 4° 37'$ E. Greenwich.

α. Teltplads paa Øen, hvor Hr. Lexaus Hus staar.

Deklination. 1876, Juni 10, fandtes ved korresponderende Højder af Prof. Mohn[1] Kronometret Mewes 575 at være $0^h 28^m 30^s$ foran Stedets Middeltid og dets daglige Acceleration 5.'93.

Samme Dags Eftermiddag bestemtes fra Teltpladsen Azimut af "Poldetind", en Fjeldtop med Varde paa Indre Sulen, der ligger i en Afstand af 18.57 Kilometer fra Husø. Der observeredes i 3 Satser (I, II og III) med Cirkelens Nulpunkt i 3 forskjellige Stillinger, og i hver Sats Omlægning af Kikkerten gjennem Zenit (1 og 2). O = Object = Poldetinds Varde. ⊙ = Cirkelaflæsning for Solens Centrum. Ch. = Kronometertid. ⊙| = Forangaaende Solrand. |⊙ = Efterfølgende Solrand. U = Uhrkorrektion. M. T. = Middeltid. E = Tidsjevning. t = Sand Soltid. δ = Solens Deklination. φ = Bredden. a = Solens Azimut. N. P. = Cirkelens Nordpunkt. A = Azimut af Objektet.

[1] H. Mohn. Astr. Obs., Side 5.

2. Husø.

$\varphi = 60° 59.'6$; $\lambda = 4° 37'$ E. Greenwich.

α. Tent on the main island, where Mr. Lexau's house stands.

Declination. — On the 10th of June, 1876, Professor Mohn[1] found the error of the chronometer, Mewes, No. 575, from equal altitudes, to be $0^h 28^m 30^s$ fast on local mean time, and its daily acceleration 5.'93.

In the afternoon of the same day, the azimuth of "Poldetind," a mountain-top with a trigonometrical signal, on the island of Indre Sulen, distant from Husø 18.57 kilometres, was determined from the tent. We observed in three sets (I, II, and III), with the zero-point of the horizontal circle in three different positions, and for each set reversing the telescope through the zenith (1 and 2). O = object = Poldetind signal; ⊙ = reading of limb corresponding to the sun's centre; Ch = time by chronometer; ⊙ = preceding solar limb; ⊙ = following solar limb; U = error of chronometer; M. T. = mean time; E = equation of time; t = apparent solar time; δ = declination of sun; φ = latitude; a = azimuth of sun; N. P. = circle reading corresponding to the astronomical meridian (North Point); A = azimuth of object.

[1] H. Mohn. Astronomical Observations, p. 5.

	I 1	I 2	I M.	II 1	II 2	II M.	III 1	III 2	III M.
O.	165° 7.'1	7.'5	165° 7.'3	44° 55.'5	55.'0	44° 55.'25	284° 32.'0	31.'25	284° 31.'6
⊙	46 16.5	67.5	46 42.0	289 52.5	104.5	290 18.5	173 15.0	71.25	173 43.1
Ch. ⊙|	7^h 3^m 0.'5	7^m 3.'5	7^h 5^m 2.'0	7^h 21^m 26.'0	25^m 32.'5	7^h 23^m 29.'2	7^h 39^m 31.'5	44^m 9.'0	7^h 41^m 50.'3
„ |⊙	5 38.3	9 41.5	7 39.9	24 4.2	28 9.4	26 6.8	42 7.0	46 43.7	44 25.3
Ch.			7^h 6^m 20.'95			7 24 48.0			7 43 7.8
U.			— 0 28 31.53			— 0 28 31.6			— 0 28 31.7
M. T.			6 37 49.4			6 56 16.4			7 14 36.1
E.			+ 44.0			+ 43.9			+ 43.9
t			6 38 33.4			6 57 0.3			7 15 20.0
δ			23° 4' 20"			23° 4' 20"			23° 4' 20"
φ			60 59 36			60 59 36			60 59 36
a			N 70 18.'0 W			N 66 28.'7 W			N 62 41.'0 W
⊙			46 42 0			290 18.5			173 43.1
N. P.			117 0.0			356 47.2			236 24.1
O.			165 7.3			44 55.2			284 31.6
A.			N 48° 7.3 E			N 48° 8.'0 E			N 48° 7.'5 E

Azimuth of Poldetind = N 48° 7.'6 E.

Samtidig maaltes Horizontalvinkelen mellem Poldetind og Gavlen af et Hus med Theodoliten og fandtes = 130° 50.'1. Altsaa bliver Azimut af Gavlen = N 178° 57.'7 E eller S 1° 2.'3 E.

The horizontal angle between Poldetind and the gable of a house, was measured at the same time with the theodolite, and found to be 130° 50.'1. Hence, the azimuth of the gable = N 178° 57.'7 E, or S 1° 2.'3 E.

Klokkeslet. (Hour.)	Magnet I.	Gavl. (Gable.)	Diff.	Magnet II.	Gavl. (Gable.)	Diff.	M.	Decl.
3^h 20^m p. m.	278° 39'	295° 44'	17° 5'	278° 27'	295° 46.'5	17° 20'	17° 12.'5	18° 14.'8
7 30 „ „	218 13	235 22	17 9	217 49	235 22	17 33	17 21.0	18 23.3
5^h 25^m p. m.								18° 19.'

Den 13de Juni tog Prof. Mohn følgende Observationer til Bestemmelse af Deklinationen, paa samme Tid som jeg svang Skibet for at bestemme Compassernes Deviation. Stativet med Theodoliten rykkedes 0.75 Meter mod Sydsydost fra den forrige Plads. Herved bliver Azimut af Poldetind fra den nye Plads 0.'1 mindre; eller N 48° 7.'5 E.

Magnetometret opstilledes paa sin Plads og der gjordes følgende Observationer, med Instrumentets egen Kikkert, for at bestemme Magnet-Axens Collimation.

On the 13th of June, Professor Mohn took the following observations to determine the declination, whilst I swung the ship for deviation of compass. The theodolite and stand was now moved 0.75 metre south-south-east from its former position. Taken from this point, the azimuth of Poldetind will be 0.'1 less, or N 48° 7.'5 E.

After mounting the magnetometer, he took the following observations, with the telescope of the instrument, to determine the collimation of the axis of the magnet: —

Magnet I.	Magnet II.
79° 27′ 20″	79° 6′ 35″
28 35	7 30
27 35	
M. 79° 27′ 50″	79° 7′.2.″5

$^1/_2$ Diff. = 10′ 24″ = 10.′4

Med Theodoliten toges følgende Observationer.

With the theodolite he took the following observations: —

Klokkeslet. (Hour.)	Magnet II.	Poldetind.	Declination.
22ʰ 34ᵐ	266° 33′	153° 19′	18° 28′ W.
54	43	19	18
23 11	41	—	20
53	40	19.5	20
0 28	48	17.5	12
31	44.5	—	16
53	51	18	9
1 5	48	17	11
32	44	—	15
51	42	—	17
3 55	44	17	15
4 17	46	17	13
27	47	17	12
54	48	17.5	12
5 5	49	—	10
22	50	—	9
37	49.5	17	9
59	50	—	9
6 16	51	17.5	9
49	53	—	6

Ved grafisk Udjevning findes følgende Værdier for Deklinationen.

Computed from diagramatic interpolation, the following values were found for the declination: —

22ʰ 30ᵐ	18° 25	1ʰ 30ᵐ	18° 15′	4ʰ 30ᵐ	18° 12′
23 0	22	2 0	17	5 0	11
23 30	19	2 30	19	5 30	10
0 0	17	3 0	18	6 0	9
0 30	13	3 30	16	6 30	8
1 0	12	4 0	15	7 0	7

og saaledes i Middel for Kl. 2.45ᵐ Deklination = 18° 14.′7 W.

and thus, as a mean for 2.45 p. m. the declination is 18° 14.′7 W.

Horizontal-Intensitet.

1876, Juni 10.

Afbøjnings-Observation. Kl. 5.5 Min. Eft. til 6.0 Min. E. $t_0 = 50.^\circ5$; $r_0 = 1$, $u_0 = 29^\circ\ 30'\ 47''$; $r_0' = 1.3$, $u_0' = 12^\circ\ 49'\ 35''$. C. Wille.

Svingnings-Observation. Kl. 4.3 Min. Eft. til 4.15 Min. Eft.

$t_0 = 52.^\circ1$, $T_0 = 4.''52585$; $s = 4.'88$; $\alpha = 76'$; $\alpha' = 19'$; $u = 12.'82$. C. Wille.

Resultat. $P = 0.022999$; $m = 0.76534$; $X = 3.1732$.

1876, Juni 15.

Svingnings-Observation. Kl. 12.15 Min. til 12.27 Min. Eft.

$t_0 = 56.^\circ8$; $T_0 = 4.''53062$; $s = 4.'9$; $\alpha = 50'$ $\alpha' = 31'$, $u = 12.'51$. H. Mohn.

Afbøjnings-Observation. Kl. 1.20 Min. til 1.45 Min. Eft.

$t_0 = 56.'2$; $u_0 = 29^\circ\ 29'\ 40''$; $u_0' = 12^\circ\ 48'\ 35''$. H. Mohn.

Resultat. $P = 0.02462$; $m = 0.76500$; $X = 3.1751$.

Svingnings-Observation. Kl. 2.4 Min. til 2.16 Min. Efterm.

$t_0 = 57.^\circ2$, $T_0 = 4.''52815$; $s = 4.'9$; $\alpha = 72'$; $\alpha' = 22'$, $u = 10.'87$. H. Mohn.

Efter den foregaaende Afbøjnings-Observation beregnes $X = 3.1750$.

Svingnings-Observation. Kl. 6.6 Min. til 6.17 Min. Efterm.

$t_0 = 54.^\circ8$, $T_0 = 4.''52880$; $s = 4.'9$; $\alpha = 57'$; $\alpha' = 19'$; $u = 9.'03$. H. Mohn.

Efter den foregaaende Afbøjnings-Observation beregnes $X = 3.1746$

1877, Juni 4.

Afbøjnings-Observation. Kl. 4.0 Min. til 4.55 Min. Efterm.

$t_0 = 52.^\circ9$; $u_0 = 28^\circ\ 37'\ 12.''5$; $u_0' = 12^\circ\ 27'\ 27.''5$. C. Wille.

Svingnings-Observation. Kl. 6.57 Min. til 7.8 Min. Efterm.

$t_0 = 48.^\circ8$; $T_0 = 4.''5902$; $s = 2.'8$; $\alpha = 74'$; $\alpha' = 26'$; $u = 3.'99$. C. Wille.

Resultat. $P = 0.02433$; $m = 0.74415$; $X = 3.1761$.

Inklination.

1876, Juni 12. Kl. 10.30 Min. til 11.45 Min. Form. Naal No. 1. C. Wille.

$\theta = 72^\circ\ 43.'35$.

Samme Dag. Kl. 1.30 Min. til 2.5 Min. Eft. Naal No. 2. C. Wille.

$\theta = 72^\circ\ 40.'96$.

Horizontal Intensity.

1876, June 10.

Observation of Deflection: — 5.5 p. m. to 6.0 p m. $t_0 = 50.^\circ5$; $r_0 = 1$; $u_0 = 29^\circ\ 30'\ 47''$; $r_0' = 1.3$; $u_0' = 12^\circ\ 49'\ 35''$. C. Wille.

Observation of Vibration: — 4.3 p. m. to 4.15 p. m.

$t_0 = 52.^\circ1$, $T_0 = 4.''52585$; $s = 4.'88$; $\alpha = 76'$; $\alpha' = 19'$; $u = 12.'82$. C. Wille.

Result. — $P = 0.022999$; $m = 0.76534$; $X = 3.1732$.

1876, June 15.

Observation of Vibration: — 12.15 p. m. to 12.27 p. m.

$t_0 = 56.^\circ8$; $T_0 = 4.''53062$; $s = 4.'9$; $\alpha = 50'$, $\alpha' = 31$, $u = 12.'51$. H. Mohn.

Observation of Deflection: — 1.20 p. m. to 1.45 p. m.

$t_0 = 56.^\circ2$; $u_0 = 29^\circ\ 29'\ 40''$, $u_0' = 12^\circ\ 48'\ 35''$. H. Mohn.

Result. — $P = 0.02462$; $m = 0.76500$; $X = 3.1751$.

Observation of Vibration: — 2.4 p. m. to 2.16 p. m.

$t_0 = 57.^\circ2$; $T_0 = 4.''52815$; $s = 4.'9$; $\alpha = 72'$; $\alpha' = 22'$, $u = 10.'87$. H. Mohn.

Computed from the preceding observation of deflection $X = 3.1750$.

Observation of Vibration: — 6.6 p. m. to 6.17 p. m.

$t_0 = 54.^\circ8$; $T_0 = 4.''52880$; $s = 4.'9$; $\alpha = 57'$; $\alpha' = 19'$; $u = 9.'03$. H. Mohn.

Computed from the preceding observation of deflection $X = 3.1746$.

1877, June 4.

Observation of Deflection: — 4.0 p. m. to 4.55 p. m.

$t_0 = 52.^\circ9$; $u_0 = 28^\circ\ 37'\ 12.''5$; $u_0 = 12^\circ\ 27'\ 27.''5$. C. Wille.

Observation of Vibration: — 6.57 p. m. to 7.8 p m.

$t_0 = 48.^\circ8$; $T_0 = 4.''5902$; $s = 2.'8$; $\alpha = 74'$; $\alpha' = 26'$; $u = 3.'99$. C. Wille.

Result. — $P = 0.02433$; $m = 0.74415$; $X = 3.1761$.

Inclination.

1876, June 12: — 10.30 a. m. to 11.45 a. m. Needle No. 1. C. Wille.

$\theta = 72^\circ\ 43.'35$.

Same Day: — 1.30 p. m. to 2.5 p. m. Needle No. 2. C. Wille.

$\theta = 72^\circ\ 40.'96$.

Samme Dag. Kl. 6.15 Min. til 7.5 Min. Eft. Naal No. 1. C. Wille.

$\theta = 72° 43.'9.$

1876, Juni 15. Kl. 10.55 Min. til 11.53 Min. Form. Naal No. 1. H. Mohn.

$\theta = 72° 46.'02.$

Samme Dag. Kl. 7.7 Min. til 7.32 Min. Eft. Naal No. 2. H. Mohn.

$\theta = 72° 45.'05.$

1877, Maj 23. Kl. 5.0 Min. til 6.45 Min. Eft. Naal No. 1. C. Wille.

$\theta = 72° 43.'35.$

Same Day: — 6.15 p. m. to 7.5 p. m. Needle No. 1. C. Wille.

$\theta = 72° 43.'9.$

1876, June 15: — 10.55 a. m. to 11.53 a. m. Needle No. 1. H. Mohn.

$\theta = 72° 46.'02.$

Same Day: — 7.7 p. m. to 7.32 p. m. Needle No. 2. H. Mohn.

$\theta = 72° 45.'05.$

1877, May 23: — 5.0 p. m. to 6.45 p. m. Needle No. 1. C. Wille.

$\theta = 72° 43.'35.$

β. Et Skjær paa Østsiden af Havnen.

Deklination. Juni 16. Iagttager: Professor Mohn.

Fra det Punkt, hvor Theodoliten var opstillet foran Magnetometret, kunde Poldetind ikke sees paa Grund af, at et nærmere liggende Fjeld kom i Vejen. Men fra et nærliggende Punkt paa Skjæret, i SSE for det første, var Poldetind synlig. Paa Øen, hvor Teltet stod, saaes Poldetind i samme Vertikal som Observationspunktet paa Skjæret, naar Theodoliten flyttedes, lodret paa Synslinien til Poldetind, 41.4 Meter mod SE fra Observationspunktet i Teltet. Heraf beregnes, at Azimut af Poldetind, seet fra Theodolitens Plads paa Skjæret, var

$$48° 7.'6 - 7.'7 = 47° 59.'9 \text{ E},$$

Fra den søndre Ende af Skjæret saaes en anden fjern Fjeldtop 10° 25′ nordenfor Poldetind. Fra Observationspunktet paa Skjæret saaes Varden paa Husø 182° 27′ til venstre for den nævnte Fjeldtop. Vinkelen mellem Husø Varde (i SW) og Poldetind (i NE) regnet over Nord var følgelig 192° 52′. Da Poldetinds Azimut var N 48° 0′ E, bliver Azimut af Husø Varde:

β. An Islet at the east side of the Harbour.

Declination. June 16. Observer Professor Mohn.

From the point at which the theodolite was mounted in front of the magnetometer, Poldetind could not be sighted, a mountain in the vicinity intercepting the view in that direction. Poldetind was visible however from an adjacent point south-south-east of the former. From the island on which was pitched the tent, Poldetind could be sighted in the same vertical as the point of observation on the islet, after moving the theodolite, perpendicular to the line of vision, 41.4 metres south-east of the point of observation in the tent. Hence, the azimuth of Poldetind as observed from the position of the theodolite on the islet, was —

$$48° 7.'6 - 7.'7 = \text{N } 47° 59.'9 \text{ E}$$

From the southern extremity of the islet could be seen another distant mountain-top, 10° 25′ north of Poldetind. Sighted from the point of observation on the islet, Husø signal was 182° 27′ to the left of that summit. The angle between Husø signal (bearing SW.) and Poldetind (bearing NE.) reckoned through the north, was accordingly 192° 52′. The azimuth of Poldetind being N 48° 0′ E, that of Husø signal is —

$$192° 52' - 48° 0' = \text{N. } 144° 52' \text{ W} = \text{S } 35° 8' \text{ W}.$$

Kl. 11.15 Min. Form. gjordes følgende Observationer:

At 11.15 a. m. the following observations were made: —

	I	II	I	II
Magnet	159° 31′	339° 3′	159° 4′	158° 50′
Husø Varde *(Husø Signal)*	213 30	393 30	213 30	213 30
Vinkel *(Angle)*	53 59	54 27	54 26	54 40
Middel *(Mean)*			S 54° 8′ W	
Azimut af Husø Varde *(Azimuth of Signal)*			S 35 8 W	
Declination			19° 0′ W	

Om Eftermiddagen opstilledes Instrumenterne paa Skjæret paa en anden Plads, i Nærheden af den forrige. Da Solen var synlig, benyttedes den til Azimutbestemmelse.

In the afternoon the instruments were set up at a point on the islet near to that previously selected. The sun being visible, the azimuth was found from solar observations.

Ch. ⊙	7h 41m 50.s 46m 17.s5	7h 44m 3.s75	Magnet I	7° 23.′75
„ ⊙	44 23.5 48 52.7	46 38.1	— II	57.0
		7 45 20.9	— I	37.0
U.		— 0 29 6.1	Magnet	7° 43.′7
M. T.		7 16 14.8	Magnét	187° 43.′7 — 180°
E.		— 31.3	N. P.	205 45.3
t		7 15 43.5	Decl.	18° 1.′6 W.
a		N 62° 26.′8 W.		
⊙		143 18.5		
N. P.		205 45.3		

Horizontal-Intensitet.

1876. Juni 16.

Afbøjnings-Observation. Kl. 12.5 Mm. til 12.37 Min. Eft.

$t_0 = 53.^0 8$; $u_0 = 29^0\ 30'\ 52.''5$; $u_0' = 12^0\ 50'\ 25.''6$. H. Mohn.

Svingnings-Observation. Kl. 1.0 Min. til 1.10 Min. Eft.

$t_0 = 60.^0 5$; $T_0 = 4.5331$; $s = 4.'9$; $\alpha = 33'$; $\alpha' = 7'$; $u = 5.'21$. H. Mohn.

Resultat: $P = 0.02075$; $m = 0.76655$; $X = 3.1686$.

Afbøjnings-Observation. Kl. 2.0 Mm. til 2.20 Mm. Eft.

$t_0 = 53.^0 8$; $u_0 = 29^0\ 25'\ 1''$. H. Mohn.

Beregnet efter foregaaende Svingnings-Observation faaes $m = 0.7654$ og $X = 3.1734$.

Horizontal Intensity.

1876. June 16.

Observation of Deflection: — 12.5 p. m. to 12.37 p. m.

$t_0 = 53.^0 8$; $u_0 = 29^0\ 30'\ 52.''5$; $u_0' = 12^0\ 50'\ 25.''6$. H. Mohn.

Observation of Vibration: — 1.0 p. m. to 1.10 p. m.

$t_0 = 60.^0 5$; T_0 4.5331; $s = 4.'9$; $\alpha = 33'$; $\alpha' = 7'$; $u = 5.'21$. H. Mohn.

Result: — $P = 0.02075$; $m = 0.76655$; $X = 3.1686$.

Observation of Deflection: — 2.0 p. m. to 2.20 p. m.

$t_0 = 53.^0 8$; $u_0 = 29^0\ 25'\ 1''$. H. Mohn.

Computed from the preceding observation of vibration $m = 0.7654$ and $X = 3.1734$.

Inklination.

1876. Juni 16.

Kl. 6.10 Min. til 6.49 Min. Eft. Naal No. 1. H. Mohn.

$\theta = 72^0\ 44.'8$.

Inclination.

1876. June 16.

6.10 p. m. to 6.49 p. m. Needle No 1. H. Mohn.

$\theta = 72^0\ 44.'8$.

3. Reykjavik.

$\varphi = 64^0\ 8'\ 30''$; $\lambda = 21^0\ 54'\ 8''$ V. Greenwich.

Den grønne Plæne ved Konsul Simons Hus.

Deklination. 1876. Aug. 1ste fandt jeg ved correspenderende Højder af Solen, at Kronometret Kullberg viste 2h 6m 55.s6 foran Stedets Middeltid ved Middag[1]. Kronometret vandt daglig 0.s60.

Den 29de Juli om Eftermiddagen bestemte jeg Azimut af en Mire.

[1] Se H. Mohn. Astr. Obs. Side 6.

3. Reykjavik.

$\varphi = 64^0\ 8'\ 30''$; $\lambda = 21^0\ 54'\ 8''$ W. Greenwich.

The grass-plot adjoining Mr. Simson's house.

Declination. 1876. Aug. 1st I found the Kullberg chronometer, from equal solar altitudes[1], to be at noon 2h 6m 55.s6 fast on mean local time; chronometer gaining daily 0.s60.

On the 29th of July, after noon, I determined the azimuth of a mark.

[1] See H. Mohn. Astronomical Observations, p. 6.

	1	2	M.
O.	95° 10.′0	9.′5	95° 9.′75
⊙	149 54.0	150 42.5	150 18.25
Ch. ⊙	7^h 32^m 5.′5	35^m 46.′0	7^h 33^m 55.75
„ ⊙	34 41.5	38 19.5	36 30.50
			7^h 35^m 13.′1
U.			— 2 6 54.2
M. T.			5 28 18.9
E.			— 6 10.7
t			5 22 8.2
a			N 90° 5.′4 W.
⊙			150 18.25
N. P.			240 23.65
O.			95 9.75
A.			N 145 13.9 W.

5^h 30^m p. m.

	Magnet.	Mire. (*Mark.*)
I	21° 34.′0	95° 9.′5
II	22 34.5	95 10.0
I	21 37.5	95 10.0
	22° 5.′1	95° 9.′8

A = N 145° 13.′9 W
Mire = 95 9.8
N P = 240 23.7
Magnet = 202 5.1 — 180°
Decl. = 38° 18.′6 W.

Horizontal-Intensitet.

1876. Juli 31,

Afbøjnings-Observation. Kl. 10 til 11 Form.
$t_0 = 55.^{\circ}0$; $u_0 = 36^{\circ}\ 26'\ 45''$; $u_0' = 15^{\circ}\ 31'\ 55''$. C. Wille.

Svingnings-Observation. Kl. 12.6 Min. til 12. 18 Min. Eft.
$t_o = 57.^{\circ}5$; $T_0 = 5.^{s}0050$; $s = 0.^{s}60$; $\alpha = 76'$; $\alpha' = 23'$; $u = 10.'4$. C. Wille.

Resultat: P = 0.02231; $m = 0.76147$; X = 2.6141.

Svingnings-Observation. Kl. 3.57 Min. til 4.10 Min. Eft.
$t_o = 57.^{\circ}8$; $T_0 = 4.^{s}9810$; $s = 0.^{s}60$; $\alpha = 76'$; $\alpha' = 23'$; $u = 8.'5$. C. Wille.

Afbøjnings-Observation. Kl. 5.10 Min. til 6.10 Min. Eft.
$t_o = 57.^{\circ}0$; u_o — $35^{\circ}\ 59'\ 22''$. C. Wille.

Resultat: Med P = 0.02231; $m = 0.7612$; X = 2.6407.

Inklination.

1876. Juli 28. Kl. 5.0 til 6,35 Eft. Naal No. 1. C. Wille.

$\theta = 76^{\circ}\ 28.'5$.

1876. August 1. Kl. 1.20 Min. til 2.20 Min. Eft. Naal No, 2. C. Wille.

$\theta = 76^{\circ}\ 26.'3$.

Horizontal Intensity.

1876. July 31.

Observation of Deflection: — 10 a. m. to 11 a. m.
$t_0 = 55.^{\circ}0$; $u_0 = 36^{\circ}\ 26'\ 45''$; $u'_0 = 15^{\circ}\ 31'\ 55''$. C. Wille.

Observation of Vibration: — 12.6 p. m. to 12.18 p. m.
$t_0 = 57.^{\circ}5$; $T_0 = 5.^{s}0050$; $s = 0.^{s}60$; $\alpha = 76'$; $\alpha' = 23'$; $u = 10.'4$. C. Wille.

Result: — P = 0.02231; $m = 0.76147$; X = 2.6141.

Observation of Vibration: — 3.57 p. m. to 4.10 p. m.
$t_0 = 57.^{\circ}8$; $T_0 = 4.^{s}9810$; $s = 0.^{s}60$; $\alpha = 76'$; $\alpha' = 23'$; $u = 8.'5$. C. Wille.

Observation of Deflection: — 5.10 p. m. to 6.10 p. m.
$t_0 = 57.^{\circ}0$; $u_0 = 35^{\circ}\ 59'\ 22''$. C. Wille.

Result: — With P = 0.02231; $m = 0.7612$; X = 2.6407.

Inclination.

1876. July 28: — 5.0 p. m. to 6.35 p. m. Needle No. 1. C. Wille.

$\theta = 76^{\circ}\ 28.'5$.

1876. Aug. 1: — 1.20 p. m. to 2.20 p. m. Needle No. 2. C. Wille.

$\theta = 76^{\circ}\ 26.'3$.

4. Namsos.

$\varphi = 64^\circ\ 28'\ 12''$ $\lambda = 11^\circ\ 31'\ 33''$ E. Greenwich.

Ved Bunden af Bugten nordenfor Byen, c. 7 Meter fra Stranden, strax søndenfor Stien, der fører videre til en Grind.

Declination. 1876. August 19 fandt Prof. Mohn ved corresponderende Højder af Solen[1] Kronometret Frodshams Korrektion til Stedets Middeltid lig $+\ 0^h\ 31^m\ 47.'85$. Kronometret vandt daglig 5.'12.

Den 18de August om Eftermiddagen gjorde vi begge i Forening Observationer til Bestemmelse af Azimut og Deklination.

4. Namsos.

$\varphi = 54^\circ\ 28'\ 12''$ $\lambda = 11^\circ\ 31'\ 33''$ E. Greenwich.

At the head of the bay, north of the town, about 7 metres from the shore, and directly south of the pathway leading to a gate.

Declination. 1876. Aug. 19 Professor Mohn found, from equal solar altitudes,[1] the error of the Frodsham chronometer on mean local time $= 0^h\ 31^m\ 47.'85$; chronometer gaining daily 5.'12.

On the 18th of August, in the afternoon, Professor Mohn and myself took observations to determine the azimuth and declination.

Ch. ⊙|	$5^h\ 47^m\ 54'$	$51^m\ 53'$	$5^h\ 49^m\ 53.'5$	Magnet I	$98^\circ\ 26'$
„ |⊙	50 18	54 17	52 17.5	— II	99 0
			5 51 5.5	— I	98 26
U.			+ 31 51.7		$98^\circ\ 43'$
M. T.			6 22 57.2	Magnet	$278^\circ\ 43.'0 - 180^\circ$
E.			— 0 3 29.2	N. P.	292 25.9
t			6 19 28.0	Decl.	$13^\circ\ 42.'9$ W.
a			N $80^\circ\ 2.'9$ W.		
⊙			212 23.0		
N. P.			292 25.9		

Horizontal-Intensitet.

1879. Aug. 18.

Afbøjnings-Observation. Kl. 11.30 Min. Form. til 12.50 Min. Eft.

$t_\circ = 67.^\circ3$; $u_\circ = 31^\circ\ 29'\ 42''$; $u_\circ' = 13^\circ\ 35'\ 40''$. C. Wille.

Svingnings-Observation. Kl. 1.51 Min. til 2.3 Min. Eft.

$t_\circ = 70.^\circ7$; $T_\circ = 4.'7183$; $s = 5.'12$; $\alpha = 76'$; $\alpha' = 24'$; $u = 4.'1$. C. Wille.

Resultat: $P = 0.02671$; $m = 0.75760$; $X = 2.9639$.

Inklination.

1876. August 19. Kl. 10.30 Min. til 11.30 Form. Naal No. 1. C. Wille.

$$\theta = 74^\circ\ 2.'3.$$

Samme Dag. Kl. 5.0 Min. til 6.0 Min. Eft. Naal No. 2. H. Mohn.

$$\theta = 74^\circ\ 2.'3.$$

[1] H. Mohn. Astr. Obs. Side 7.

Horizontal Intensity.

1876. Aug. 18.

Observation of Deflection: — 11.30 a. m. to 12.50 p. m.

$t_\circ = 67.^\circ3$; $u_\circ = 31^\circ\ 29'\ 42''$; $u_\circ' = 13^\circ\ 35'\ 40''$. C. Wille.

Observation of Vibration: — 1.51 p. m. to 2.3 p. m.

$t_\circ = 70.^\circ7$; $T_\circ = 4.'7183$; $s = 5.'12$; $\alpha = 76'$; $\alpha' = 24'$; $u = 4.'1$. C. Wille.

Result: — $P = 0.02671$; $m = 0.75760$; $X = 2.9639$.

Inclination.

1876. Aug. 19: — 10.30 a. m. to 11.30 a. m. Needle No. 1. C. Wille.

$$\theta = 74^\circ\ 2.'3.$$

Same Day: — 5.0 p. m. to 6.0 p. m. Needle No. 2. H. Mohn.

$$\theta = 74^\circ\ 2.'3.$$

[1] H. Mohn. Astronomical Observations, p. 7.

5. Bodø.

$\varphi = 67° 17' 14''$ $\lambda = 14° 24' 51''$ E. Greenwich.

I Nærheden af Stranden, noget østenfor den østligste Landgangsbrygge.

1877. August 13 observerede Prof. Mohn Solhøjder samtidig med at jeg tog de magnetiske Observationer[1]. Ved de første fandtes umiddelbart Standen af Kronometret Frodsham for Stedets sande Tid (U').

5. Bodø.

$\varphi = 67° 17' 14''$ $\lambda = 14° 24' 51''$ E. Greenwich.

Near the shore, a little to the east of the most easterly landing-pier.

1877. Aug. 13 Professor Mohn observed altitudes of the sun, whilst I took magnetic observations[1]. By direct computation from the altitudes, he determined the error of the Frodsham chronometer on apparent local time (U').

Deklination. *Declination.*

1877. August 13.

Ch. ⊙	5^h 59^m 5.'5	6^h 4^m 22.'0	6^h 1^m 43.'75	Magnet I	80° 41.'5	
„ ⊙	6 1 27.0	6 46.0	4 6.50	— II	80 13.6	
			6 2 55.1		80 27.55	
U'			— 0 1 57.8	Magnet	260 27.55	— 180°
t			6 0 57.3	N. P.	272 8.7	
a			N 84° 4.'5 W.	Decl.	11° 41.'2 W.	
⊙			188 34.2			
N. P.			272 8.7			

Horizontal-Intensitet.

1877. Aug. 13.

Svingnings-Observation. Kl. 12.10 Min. til 12.23 Min. Eft.

$t_o = 77.°6$; $T_o = 4.''9275$; $s = 3.'4$; $\alpha = 76'$; $\alpha' = 25'$; $u = 3.'4$. C. Wille.

Afbøjnings-Observation. Kl. 4.30 Min. til 5.30 Min. Eft.

$t_o = 72.°7$; $u_o = 32° 46' 20''$; $u_o' = 14° 6' 35''$. C. Wille.

Resultat: $P = 0.02445$; $m = 0.74020$; $X = 2.7854$.

Inklination.

1877. August 13. Kl. 9.45 Min. til 11.10 Min. Form. Naal No. 1. C. Wille.

$\theta = 75° 21.'4$

Horizontal Intensity.

1877. Aug. 13.

Observation of Vibration: — 12.10 p. m. to 12.23 p. m.

$t_o = 77.°6$; $T_o = 4.''9275$; $s = 3.'4$; α 76'; $\alpha' = 25'$; $u = 3.'4$. C. Wille.

Observation of Deflection: — 4.30 p. m. to 5.30 p. m.

$t_o = 72.°7$; $u = 32° 46' 20''$; $u_o' = 14° 6' 35''$. C. Wille.

Result: — $P = 0.02445$; $m = 0.74020$; $X = 2.7854$.

Inclination.

1877. August 13: 9.45 a. m. to 11.10 a. m. Needle No. 1 C. Wille.

$\theta = 75° 21.'4$.

6. Tromsø.

$\varphi = 69° 39.'1$ $\lambda = 18° 59.'3$ E. Greenwich.

Ved Stranden, nogle hundrede Skridt nordenfor Bryggen ved Storstennes, paa Østsiden af Tromsø-Sundet.

Bredde og Længde efter de norske Kystkarter. Krometrets; Frodshams, Stand for Stedets Tid er beregnet efter dets Stand for Greenwich Tid og Kartets Længde.

[1] H. Mohn. Astr. Obs. Side 8.

6. Tromsø.

$\varphi = 69° 39.'1$ $\lambda = 18° 59.'3$ E. Greenwich.

On the beach, a few hundred paces north of the landing-pier at Storstennes, on the east side of Tromsø Sound.

Latitude and longitude from the coastal charts. Error of chronometer (Frodsham) on local time computed from error on Greenwich time and the longitude of the chart.

[1] H. Mohn. Astronomical Observations, p. 8.

Deklination. *Declination.*

1877. Juli *(July)* 11.

Ch. ⊙|	6^h 24^m 4.'0	29^m 56.'5	6^h 27^m 0.'25	Magnet I	80° 10.'25
„ |⊙	26 36.0	32 28.0	29 32.0	— II	80 20.5
			6 28 16.1		80 15.4
U.			+ 22 56.0	Magnet	260° 15.'4 — 180°
M. T.			6 51 12.1	N. P.	270 33.1
E.			— 0 5 14.5	Decl.	10 17.7 W.
t			6 45 57.6		
a			N 71° 30.'9 W		
⊙			199 2.2		
N. P.			270 33.1		

Horizontal-Intensitet.

1877. Juli 11.

Svingnings-Observation. Kl. 4.2 Min. til 4.16 Min. Eft. $t_o = 56.°4$; $T_o = 5.'0459$; $s = 3.'4$; $\alpha = 74'$; $\alpha' = 21'$; $u = 5.'7$. C. Wille.

Afbøjnings-Observation. Kl. 5.35 Min. til 6.13 Min. Eftm.

$t_o = 56.°6$; $u_o = 35° \; 0' \; 35''$; $u_o' = 14° \; 59' \; 37.''5$. C. Wille.

Resultat: $P = 0.02142$; $m = 0.74260$; $X = 2.6365$.

Inklination.

1877. Juli 11. Kl. 11.40 Min. Form. til 12.45 Min. Eft. Naal No. 1. C. Wille.

$\theta = 76° \; 21.'85$.

Horizontal Intensity.

1877. July 11.

Observation of Vibration: — 4.2 p. m. to 4.16 p. m. $t_o = 56.°4$; T_o 5.'0459; $s = 3.'4$; $\alpha = 74'$; $\alpha' = 21'$; $u = 5.'7$. C. Wille.

Observation of Deflection: — 5.35 p. m. 6.13 p. m.

$t_o = 56.°6$; $u_o = 35° \; 0' \; 35''$; $u_o' = 14° \; 59' \; 37.''5$. C. Wille.

Result: — $P = 0.02142$; $m = 0.74260$; $X = 2.6365$

Inclination.

1877. July 11: — 11.40 a. m. to 12.45 p. m. Needle No. 1. C. Wille.

$\theta = 76° \; 21.'85$.

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7. Hammerfest.

$\varphi = 70° \; 40' \; 11''$ $\lambda = 23° \; 40' \; 26''$ E. Greenwich.

Paa Fuglenes, i Nærheden af Meridianstøtten. Tidsbestemmelse ved Solhøjder af Prof. Mohn den 9de og 10de Juli 1878.[1]

Deklination.

1878. Juli 9 om Eftermiddagen bestemte vi Azimut af Kirkespiret. Observationsuhr Lommekronometer, hvis Korrektion til Stedets sande Tid var funden = $+ 51^m \; 20.'4$.

Den 10de Juli Kl. 12.35 Min. Eft., bestemte jeg Deklinationen.

[1] H. Mohn. Astr. Obs. Side 12—14.

7. Hammerfest.

$\varphi = 70° \; 40' \; 11''$ $\lambda = 23° \; 40' \; 26''$ E. Greenwich.

At Fuglenes, near by the arc of meridian terminus column. Error of chronometer found from altitudes of the sun, taken by Professor Mohn on the 9th and 10th of July, 1878.[1]

Declination.

1878. July 9, in the afternoon, we determined the azimuth of the church spire, observing with the pocket-chronometer, for which the error on local apparent time was found to be $+ 51^m \; 20.'4$.

On the 10th of July, 12 35 p. m, I determined the declination.

[1] H. Mohn. Astronomical Observations, p. 12—14.

O.	229° 9′	10.′0	229° 9.′5
⊙	18 41.5	19° 27.0	19 4.25
Ch. ⊙	6^h 14^m 26.′4	17^m 46.′0	6^h 16^m 6.′2
⊙	16 50.0	20 15.0	18 32.5
			6 17 19.35
U′			+ 51 20.4
t			7^h 8^m 39.75
a			N 66° 32.′5 W
⊙			19 4.25
N. P.			85° 36.′75
O.			229 9.5
A.			N 143° 32.′75 E.

	Magnet.	Mire. (*Mark.*)
I	80° 4.′0	48° 51.′5
II	79 36.7	48 52.0
	79 50.35	48 51.75
A =		N 143° 32.′75 E.
Mire		48 51.75
N. P.		265 19.0
Magnet		259 50.35 — 180°
Decl.		5° 28.′6 W.

Horizontal-Intensitet.

Svingnings-Observation. 1878. Juli 9. Kl. 5.40 Min. til 5.52 Min. Eft.

$t_o = 55.°7$; $T_o = 5.'0660$; $s = 7.'0$; $\alpha = 76'$; $\alpha' = 19'$; $u = 2.'49$. C. Wille.

Afbøjnings-Observation. 1878. Juli 10. Kl. 12.45 Min. til 1.30 Min. Eft.

$t_o = 64.°9$; $u_o = 37° \ 22' \ 9''$; $u_o' = 15° \ 54' \ 10''$. C. Wille.

Resultat: P = 0.01896; $m = 0.7627$;[1] X = 2.5484.

Inklination.

1878. Juli 10. Kl. 10.45 Min. til 11.55 Min. Form. Naal No. 1. C. Wille.

$\theta = 76° \ 54.'25$.

Horizontal Intensity.

Observation of Vibration. 1878. July 9: — 5.40 p. m. to 5.52 p. m.

$t_o = 55.°7$; $T_o = 5.'0660$; $s = 7.'0$; $\alpha = 76'$; $\alpha' = 19'$; $u = 2.'49$. C. Wille.

Observation of Deflection. 1878. July 10: — 12.45 p. m. to 1.30 p. m.

$t_o = 64.°9$; $u_o = 37° \ 22' \ 9''$; $u_o' = 15° \ 54' \ 10''$. C. Wille.

Result: — P = 0.01866; $m = 0.7627$;[1] X = 2.5484.

Inclination.

1878. July 10: — 10.45 a. m. to 11.55 a. m. Needle No. 1. C. Wille.

$\theta = 76° \ 54.'25$.

8. Vardø.

$\varphi = 70° \ 22' \ 24''$ $\lambda = 31° \ 7' \ 51''$ E. Greenwich.

Paa Fæstningen Vardøhus's Glacis, 170 Meter Nord for Fæstningens Midtpunkt.

Horizontal-Intensitet.

Svingnings-Observation. 1878. Juni 26. Kl. 1.4 Min. til 1.13 Min. Eft.

$t_o = 50.°4$; $T_o = 5.'0418$; $s = 8.'0$; $\alpha = 72'$; $\alpha' = 28''$; $u = 4.'08$. C. Wille.

Afbøjnings-Observation. 1878. Juni 26. Kl. 5.10 Min til 6.5 Min. Eft.

$t_o = 47.°8$; $u_o = 37° \ 11' \ 12''$; $u_o' = 15° \ 48' \ 30''$. C. Wille.

Resultat: P = 0.02259; $m = 0.7616$ X = 2.5737.

Inklination.

1878. Juni 26. Kl. 10.40 Min. til 11.37 Min. Form. Naal No. 1. C. Wille.

$\theta = 76° \ 52.'4$.

8. Vardø.

$\varphi = 70° \ 22' \ 24''$ $\lambda = 31° \ 7' \ 51''$ E. Greenwich.

The glacis of Vardøhus, 170 metres north of the centre of the fortress.

Horizontal Intensity.

Observation of Vibration. 1878. June 26: — 1.4 p. m. to 1.13 p. m.

$t_o = 50.°4$; $T_o = 5.'0418$; $s = 8.'0$; $\alpha = 72'$; $\alpha' = 28'$; $u = 4.'08$. C. Wille.

Observation of Deflection. 1878. June 26: — 5.10 p. m. to 6.5 p. m.

$t_o = 47.°8$; $u_o = 37° \ 11' \ 12''$; $u_o' = 15° \ 48' \ 30''$. C. Wille.

Result: — P = 0.02259; $m = 0.7616$; X = 2.5737.

Inclination.

1878. June 26. 10.40 a. m. to 11.37 a. m. Needle No. 1. C. Wille.

$\theta = 76° \ 52.'4$.

[1] Magneten var i 1878 opmagnetiseret.

[1] The Magnet had been re-magnetised in 1878.

B. Observationer i Søen og deres Resultater.

Ved Expeditionens Udrustning var det paatænkt, at der skulde gjøres fuldstændige magnetiske Observationer ombord, naar man var i Søen. Hertil havdes fuldstændigt Apparat i Admiralitets Standard-Kompasset og Fox-Cirkelen. Med denne sidste foretog jeg i 1876, under Skibets Udrustning, paa Bergens Observatorium de nødvendige Afvejninger. Under Expeditionens Ophold i Husø fra den 10de til 19de Juni samme Aar gjordes alle de fornødne Basis-Observationer. De magnetiske Elementers Størrelse bestemtes, som ovenfor vist, i Land ved absolute Maalinger. Deviationen bestemtes saavel for Styre-Kompasset som for Fox-Cirkelens Plads og med Fox-Cirkelen maaltes Inklination og Intensitet under forskjellige anlagte Kurser, idet Skibet blev svunget ved Hjælp af Trosser. Der toges Svingnings-Observationer til Bestemmelse af Coefficienterne μ og λ.

Ved Beregningen af de med Fox-Cirkelen ombord maalte Inklinationer og Intensiteter, fandt Prof. Mohn, at disse ikke kunde bringes til indbyrdes Harmoni, med mindre Indexfejlen for Fox-Cirkelens Naal sattes hele 19 Minuter større, end den fandtes af de Observationer, der var gjorte i Land paa samme Sted og til samme Tid med Fox-Cirkelen og med Inklinatoriet.

Da vi den 22de Juni 1876 i meget roligt Vejr og rolig Sø forsøgte Observationer med Fox-Cirkelen, viste det sig, at Skibet, vel nærmest paa Grund af det langsomt virkende Styreapparat,[1] ikke kunde holdes paa Kurs med den Støhed, som udfordredes til at Observationerne kunde gjøres med nogenlunde Nøjagtighed, ligesom Skibets vertikale Bevægelser uagtet den rolige Sø viste sig yderst hindrende i samme Retning. Beregningen af Observationerne gav ogsaa et utilfredsstillende Resultat. Kun en Gang senere forsøgtes, nemlig under Sejladsen ind til Thorshavn, Observationer med Fox-Cirkelen. Det yderst urolige Vejr, som Expeditionen havde i 1876, forbød alle videre Forsøg i dette Aar.

I 1877 hindrede saavel Vejret, som den Omstændighed, at jeg maatte gaa fra Husø til Bergen for at faa indsat ny Mellemaxel i Maskinen, mig i at foretage Basis-Observationer. I 1878 var Expeditionen under Rejserne saa ganske optagen af andre mere nødvendige Gjøremaal, at der ikke levnedes Tid til at tage andre magnetiske Observationer ombord end til Bestemmelse af Misvisningen.

Saaledes forenede sig Skibets magnetiske Konstitution, om jeg saa maa kalde det, dets langsomtvirkende Styreapparat, dets Letbevægelighed og ringe Bredde, uroligt Vejr, Reparation af Maskinen og Hensynet til Expeditionens Hovedarbejder, Lodninger, Temperaturmaalinger og Skrabninger, til absolute Hindringer mod Fox-Cirkelens

[1] C. Wille. Apparaterne og deres Brug. Side 4.

B. Observations at Sea, and their Results.

The Scheme of Work approved for the Expedition included complete series of magnetic observations at sea, for which we had the Admiralty standard compass and the Fox circle. With the latter instrument, I undertook in 1876, at the Bergen Observatory, whilst the ship was fitting out, the necessary weighings. During the stay of the Expedition at Husø, from the 10th to the 19th of June, same year, were taken all necessary base-observations. The deviation was determined alike for the steering-compass and the position of the Fox circle, and inclination and intensity were observed with the Fox circle on different courses, the ship being swung the while by means of hawsers. Observations of vibration were taken to determine the coefficients μ and λ.

In his computations of inclination and intensity observed on board with the Fox circle, Professor Mohn could not, he found, attain satisfactory agreement for the respective results unless the index-error for the needle of the Fox circle were put as much as 19 minutes greater than the error found from the observations taken on shore in the same place and at the same time with the Fox circle and with the dip circle.

On taking a few preliminary observations with the Fox circle, June 22nd 1876, in very fine weather and a calm sea, it was found impossible, chiefly no doubt owing to the tardy action of the steering-apparatus,[1] to keep the ship sufficiently steady on her course for observing with comparative accuracy; moreover, the vertical motion of the vessel, calm as was the sea, proved a serious obstacle to the attainment of anything like trustworthy determinations. The computed results, too, were not to be relied upon. Only once afterwards, viz. when nearing Thorshavn, did we try to observe with the Fox circle; indeed the boisterous weather encountered by the Expedition throughout the summer of 1876, precluded any further attempt on the first cruise.

In 1877 I had no opportunity of taking base-observations, both by reason of the weather and the discovery, on arriving at Husø, of a defect in the engine-shaft, necessitating our immediate return to Bergen to get a new one put in. In 1878 the prosecution of other and more important exploratory work left no time for magnetic observations save those required to determine declination.

Thus, the ship's magnetic properties, so to speak, the slow action of her steering-apparatus, her great mobility and trifling breadth of beam, rough weather, time lost in repairing the engine, and regard to the main objects of the Expedition, viz. sounding, determining temperature, and dredging the bottom, — proved one with the other in-

[1] C. Wille. The Apparatus, and How Used, p. 4.

Anvendelse i Søen. Betingelser for dens heldige Anvendelse er et bredt Fartøj, en let Styring, roligt Vejr og tilstrækkelig Tid, samt fremfor alt en saadan Plads for Instrumentet, at de med samme tagne Bestemmelser af Inklination og Intensitet harmonerer.

Det er saaledes kun Misvisnings-Observationerne, der have ledet til brugbare Resultater.

Førend jeg gaar over til at beskrive den i Søen anvendte Fremgangsmaade og give de beregnede Resultater, maa jeg først omtale Resultaterne af de Observationer, som gjordes i Husø til Bestemmelse af Kompassets Deviation.

Den 13de Juni 1876 svang jeg Skibet paa Husø Havn for at bestemme Kompassets Deviation. Svingningen udførtes ved Trosser, fastgjorte i Land. For hver anlagt Kurs (16 forskjellige Streger), paa hvilke der observeredes, pejledes med Kompasset Varden paa Poldetind. Samtidig observerede paa Teltpladsen i Land Prof. Mohn, paa givet Signal, Magnetometret til Bestemmelse af den absolute Deklination. Fra Teltpladsen var, som ovenfor Side 8 anført, Azimut af Varden paa Poldetind N 48° 7.'5 E. Da Fartøjet (Standard Kompasset ombord) under Svingningen laa meget nær i Vertikalplanet mellem Teltpladsen og Poldetind, bliver Azimut af Poldetind for Standard-Kompasset ombord N 48.°1 E. Poldetinds Afstand fra Husø er 10 Kvartmil, saa at en Forrykning lodret paa Sigtelinen mellem begge Steder af 0.°1 svarer til 32.4 Meter, en Afstand, der er meget større end Forrykningen af Kompassets Plads under Svingningen.

Trækkes Azimut af Poldetind — 48.°1 — fra Pejlingen af Poldetind, faar man det sande Azimut af Kompasnaalens Nordende eller den devierende Misvisning. Den følgende Tabel indeholder Observationerne og de deraf beregnede Værdier for devierende Misvisning.

superable obstacles to the use of the Fox circle at sea. The conditions for successful observation with the instrument are a vessel broad in the beam and easy to steer, calm weather and sufficient time, and above all such a position for the instrument as will admit of satisfactory agreement in its determinations of inclination and intensity.

Hence, the only observations attended with trustworthy results, were those taken to find the declination.

Before proceeding to describe the method adopted at sea and give the computed results, I must first set forth the results of the observations taken at Husø for determining the deviation of the compass.

On the 13th of June, 1876, I swung the ship in Husø harbour, by means of hawsers, to obtain the deviation of the compass. For every course by compass (16 different points) on which I observed, the bearing of the Poldetind signal was taken with the compass, Professor Mohn, at a given signal, simultaneously observing the magnetometer in the tent on shore, to determine the absolute declination. As previously stated, page 8, the azimuth of the Poldetind signal from the tent was N. 48° 7.'5 E. Now, as the ship (standard compass on board) lay when swinging very nearly in the vertical plane between the tent and Poldetind, the azimuth of Poldetind for the standard compass on board will be N. 48.°1 E. The distance of Poldetind from Husø is 10 miles; and hence a change in position of 0.°1 perpendicular to the line of vision between both places, corresponds to 32.4 metres, a distance much greater than is that corresponding to the change in the position of the compass during the swinging of the ship.

If the azimuth of Poldetind — 48.°1 — be subtracted from the bearing of Poldetind, we get the true azimuth of the north end of the compass-needle, or the deviating variation. In the following Table are given the observations, and the values computed from them, for deviating variation.

Klokkeslet. (*Hour.*)	Anlagt Kurs paa St. Kompas. (*Ship's Head by Stnd. Compass.*)	Pejling af Poldetind. (*Bearing of Poldetind.*)	Devierende Misvisning. (*Deviating Variation.*)
10h 34m a. m.	S 0.°2 E	N 66.°0 E	N 17.°9 W
10 55	S 21.6 E	75.1	27.0
11 58	S 45.0 E	82.3	34.2
0 28 p. m.	S 67.4 E	85.4	37.3
0 49	E	85.0	36.9
1 5	N 67.5 E	82.7	34.6
1 29	N 44.9 E	77.7	29.6
1 32	N 22.5 E	72.5	24.4
1 51	N 0.2 E	67.0	18.9
4 15	N 22.7 W	61.5	13.4
4 32	N 45.3 W	56.3	8.2
4 52	N 67.5 W	51.9	3.8
5 21	N 89.7 W	48.6	0.5
5 40	S 67.2 W	48.3	0.2
5 58	S 45.3 W	50.5	2.4
6 15	S 22.8 W	57.1	9.0
6 45	S 0.7 E	66.0	17.9

Tallene i den sidste Rubrik, den devierende Misvisning, afsattes som Ordinater paa Rudepapir, med Tallene i den anden Rubrik, anlagt Kurs paa Standard-Kompas, som Argument. Paa grafisk Vej droges mellem de afsatte Punkter den sandsynligste Kurve, og af denne Kurve udtoges følgende Værdier: C = Anlagt Kurs efter St. Kompasset. D = Devierende Misvisning.

The figures in the last column, the deviating variation, were set down as ordinates on ruled paper, with the figures in the second column as abscissæ. A free hand curve was then drawn as nearly as possible through all the marked points, and from this curve were deduced the following values (C signifies "course by compass;" D, "deviating variation"): —

C	*D*	*C*	*D*	*C*	*D*	*C*	*D*
N	18.°8 W	E	37.°0 W	S	17.°8 W	W	0.°4 W
N 10° E	21.3	S 80° E	37.4	S 10° W	13.8	N 80° W	1.6
20	23.8	70	37.3	20	10.0	70	3.3
30	26.1	60	36.6	30	6.6	60	5.2
40	28.4	50	35.2	40	3.8	50	7.2
50	30.8	40	33.0	50	1.6	40	9.4
60	33.1	30	30.0	60	0.6	30	11.8
70	35.0	20	26.5	70	0.1	20	14.0
80	36.4	10	22.1	80	0.0	10	16.5

Medium af de devierende Misvisninger i denne Tabel er

18.°68 West.

Ifølge Side 7 var Middel-Misvisningen paa Teltpladsen paa samme Tid 18° 14.′7 = 18°.24.

Paa Skjæret østenfor Havnen fandt Prof. Mohn (Side 11) den 16de Juni Misvisningen om Formiddagen = 19° 0′, om Eftermiddagen 18° 2′, i Middel 18° 31′ = 18°.52. Da Fartøjet under Svingningen laa mellem Teltpladsen og Skjæret, turde det være rigtigst at sætte Misvisningen paa Skibets Plads lig

18.°38 West.

Dette Tal er kun 0.°30 mindre end *Middeltallet af de devierende Misvisninger ombord. Det sidste giver saaledes den sande Misvisning med en Nøjagtighed af mindst en halv Grad.* Efter dette Princip udførtes Misvisningsbestemmelserne i Søen. Til Bedømmelse af Skibets magnetiske Forhold hidsættes de beregnede Værdier for Konstanterne i Deviations-Formelen.

The mean of deviating variation in this Table is

18.°68 W.

As previously shown, page 11, the mean declination simultaneously found at the tent was 18° 14.′7 = 18.°24.

On the islet east of the harbour, Professor Mohn found the declination in the forenoon of the 16th of June = 19° 0′, in the afternoon 18° 2′, giving a mean of 18° 31′ = 18.°52. Now, as the vessel lay when swinging between the tent and the islet, the declination for the ship's position may be put at

18.°38 W.

This value is only 0.°30 less than *the mean of the deviating variations observed on board. Hence, this mean gives the true variation within half a degree.* On this principle was determined the variation at sea. To show the magnetic influence of the vessel, the computed values of the constants in the deviation formula are here given: —

$$A = 0.°0;\ B = -18.°47;\ C = -0.°45;\ D = +2.°47;\ E = +0.°23.$$

Deviationen er 0 for anlagt Kurs Nord og Syd, Maximum, 18.°5, for Ost og West.

The deviation is 0 with the ship's head due north or south, its maximum with the ship's head due east or west being 18.°5.

Misvisnings-Bestemmelserne i Søen udførtes paa følgende Maade. Skibet blev, i roligt Vejr og under Solskin, ved Maskine og Ror bragt til at ligge an forskjellige, i Regelen 16, Kurser, saa jevnt som muligt fordelte over hele Horizonten. For hver af disse anlagte Kurser bestemtes Vinkelen mellem Diametralplanet og Solens Vertikal-

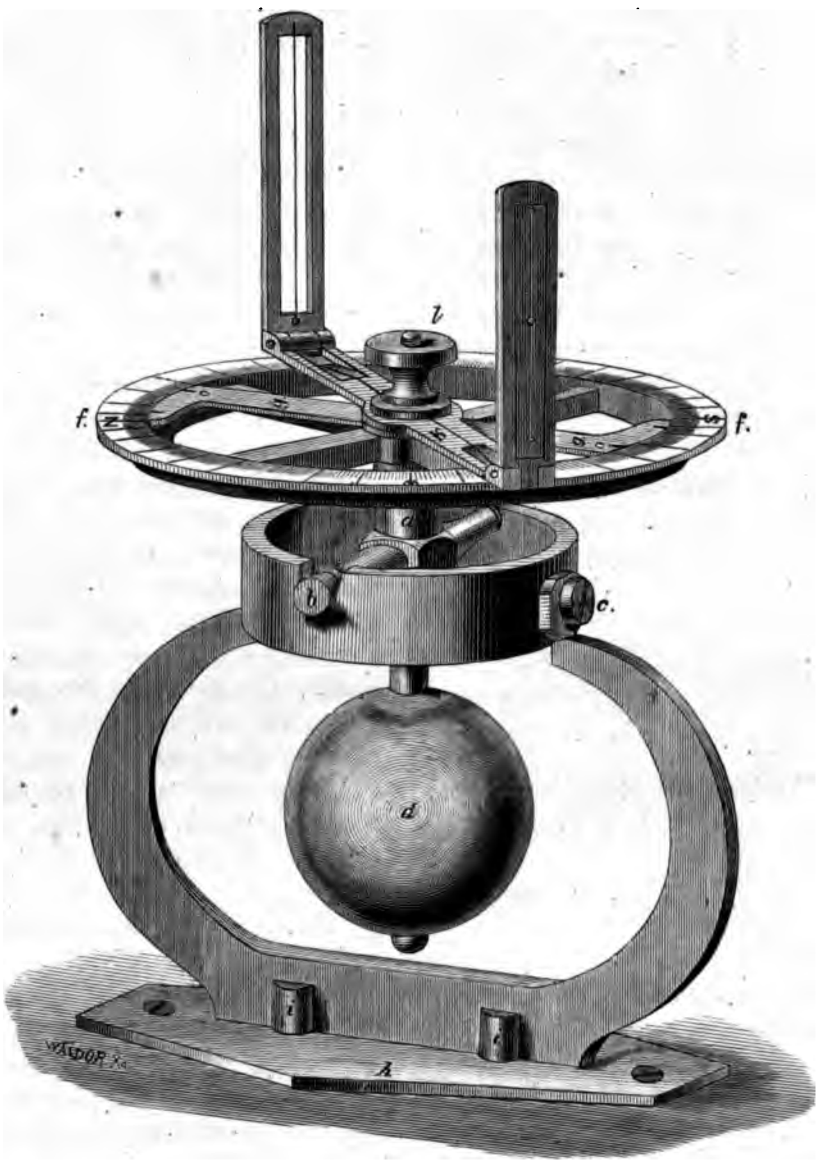
The determinations of declination at sea were performed as follows: — In calm, bright weather the ship's head was brought upon different points of the compass, as a rule 16, as regularly distributed round the circumference as possible. For each of these points was determined the angle between the midship line and the vertical circle of

cirkel. Dette gjordes en enkelt Gang (i 1877) ved Hjælp af Kompassets Pejlapparat, men i Regelen (i 1878) paa nedenfor beskrevne Maade.

Da enhver Pejlings-Nøjagtighed væsentligst beror paa, at Kompasnaalen er i Ro og rigtig indstillet i den devierende magnetiske Meridian, og da Naalen let kan bringes i Svingninger ved Manipulationen af Pejlapparatet, naar dette er anbragt direkte paa Kompasdaasen, anvendtes til Pejlinger Wille's Azimuth Pejlskive, et Instrument, som jeg konstruerede i 1869 og som siden har været reglementeret i den norske Marine. Instrumentet er fremstillet i hosstaaende Figur, og vil lettelig forstaaes af Tegningen.

the sun. On one occasion (1877) this was done by means of the sight vanes on the standard compass, but subsequently without exception in the manner described below.

As the accuracy of every bearing is mainly dependent upon the compass-needle being steady, and parallel to the deviating magnetic meridian, and as the needle will be easily caused to vibrate when manipulating the bearing apparatus, if the latter be fixed direct to the compass-box, — all bearings were taken with Wille's Azimuth Dumbcard, an instrument devised by the author in 1869, and which has since been officially adopted for the Norwegian Navy. The instrument is represented in the Figure.



Paa Grund af Bevægeligheden om Tapperne *b* og *c* vil Kuglen *d*, der er af Bly, altid holde Tappen *a* vertikal, og Ringen *f*, der med sit Centerstykke kan drejes om den øvre Del af Tappen *a*, vil saaledes indtage en horizontal Stilling og bibeholde denne under Skibets Bevægelser. Ringen er inddelt i 360° og er tillige mærket med de 8 Hovedstreger N, NO, O, SO o. s. v. Til Overkant af Tappen *a* er fastskruet Tverstykket *g*, paa hvilket er an-

The ball *d*, which is of lead, moving readily on the pivots *b* and *c*, will always keep the pivot *a* perpendicular; and the ring *f*, which along with its centre-piece can be made to revolve about the upper part of the pivot *a*, will accordingly take a horizontal position and keep it during the motion of the vessel. The ring is divided into 360 degrees, with separate marks for the 8 cardinal points, N., NE., E., SE., &c. To the upper edge of the pivot *a* is

mærket to diametralt staaende Nulpunkter (Indexer), og Beslaget h skal være saaledes placeret, at naar Pejlskiven nedsættes i dette med sine to Tapper $i\,i$, saa skal Linjen mellem de to Nulstreger paa det faste Tverstykke g være parallel med Skibets Diametralplan. Om en tyndere Fortsættelse af Tappen a bevæger sig Diopterlinealen k med sine Dioptere, og kan fæstes i en hvilkensomhelst Vinkel med g ved Hjælp af Skruen l.

Pejlingen foregik altsaa saaledes: En Observatør passede Styringen og aflæste nøjagtig anlagt Kurs i Observationsøjeblikket, en anden havde Kronometret og Noticebogen, og en tredie stod ved Pejlskiven. Naar Skibet gik støt, uden Giringer, og Kompasnaalen var i Ro, pejltes Solen enten direkte eller, naar den var højere paa Himlen, ved Hjælp af Skyggen af den vertikale Traad og Diameterstregen paa Linealen k. Naar disse var nøjagtig overet, raabtes "Nu!" og Kronometrets Visende noteredes; derefter opgaves anlagt Kurs, der ligeledes noteredes, og Ringen f drejedes saaledes, at den samme Kursstreg kom overet med Nulpunktet paa g. Inddelingen paa Ringen havde da nøjagtig samme Stilling til Diametralplanet som Inddelingen paa Kompasrosen havde i det Øjeblik, da der blev raabt "Nu", hvorpaa Pejlingen aflæstes paa Ringen i Aabningen og ligeud for Diameterstregen paa Linealen k, som om den var aflæst direkte paa Kompasrosen. Dersom Linealen k under en forlig eller agterlig Pejling dækker Nulstregen, benyttes de to Hjælpestreger, der er anbragte et vist Antal Grader til Siden af den egentlige Nulstreg.

Kronometrets Stand for sand Tid ombord bestemtes enten efter dets Stand for Greenwich Tid og Skibets beregnede Længde eller, naar Dagstiden var gunstig, det er Solen ikke for nær Meridianen, ved at tage nogle Solhøjder og deraf beregne Solens Timevinkel.

Af den saaledes fundne Uhrkorrektion, den efter Kronometret noterede Tid, Bredden og Solens Deklination beregnedes Solens Azimut. Forskjellen mellem Solens sande Azimut og Pejlingen af Solen gav de til de forskjellige anlagte Kurser svarende Værdier for den devierende Misvisning. Efter den ovenbeskrevne grafiske Methode bestemtes derpaa Middeltallet af de ækvidstante Værdier for denne, hvilket antoges som den sande Misvisning.

De følgende Tabeller indeholder Observationerne og de deraf udledede Resultater. t = Klokkeslettet efter sand Soltid, S Pejling af Solen, a Solens Azimut.

screwed a cross-piece, g, marked with two diametrically opposite zero-points (indices), and the frame h must be so placed that, on inserting into it the dumb-card with its two pivots $i\,i$, the line between the two zero-points on the fixed cross-piece g will be parallel to the middle fore and aft line of the ship. On a thinner continuation of the pivot a moves a cross-piece, k, with sight-vanes, which admits of being fixed at any required angle with g by means of the screw l.

The bearings were taken accordingly as follows: — One observer looked to the steering, and read off the exact compass course at the moment of observation, another had charge of the chronometer and noted the time, and a third observed the azimuth dumb-card. Now, when the ship kept steady on her course without yawing, and with the compass-needle at rest, the bearing of the sun was taken either direct or, for greater altitudes, by the shadow of the vertical wire and the diameter-line on the cross-piece k. The moment the shadow of the thread and the line were exactly coincident, observer No. 3 called out to his colleague with the chronometer, who noted and entered the time, after which the direction of the ship's head by the compass was given, and entered in the note-book, the ring f being then moved in such manner that the division corresponding to the direction of the ship's head by compass was made coincident with the zero-point on the cross-piece g. Hence, the division-lines on the ring had precisely the same position relative to the midship line as the division-lines on the compass-card at the moment observer No. 3 called out, and the bearing was then read off through the open space in the centrepiece k, the extremities of the diameter-line being the index, exactly as though it had been read off direct from the compass-card. Should the piece k when taking a bearing in or near the direction of the fore and aft midship line cover the zero-point, recourse is in that case had to the two lines drawn a certain number of degrees from the true zero-point, one on either side.

The error of the chronometer on apparent time on board was found either from its error on Greenwich time and the ship's computed longitude, or, at a favourable hour of the day, i. e. with the sun not too near the meridian, by taking a few solar altitudes and computing the hour-angle of the sun.

From the error of the chronometer thus determined, the observed chronometer-time, the latitude, and the sun's declination, was computed the azimuth of the sun. The difference between the true azimuth and the bearing of the sun gave the values for deviating variation corresponding to the different compass courses. By the diagramatic method described above was found the mean of the equidistant values for the deviating variation, which we assumed to be the true declination.

In the following Tables are set forth the observations and their computed results: t signifies apparent time; S, bearing of sun; a, azimuth of sun.

I. Vestfjorden. *(The West Fjord).* 1877. August 10.

$\varphi = 68° 5'$ N. $\lambda = 14° 30'$ E. Greenwich.

No.	C	t	a	S	D
1	SE	4h 48m 50s	N 100° 42' W	N 71° 40' W	29.°0 W
2	SE	49 53	100 27	71 20	29.1
3	SSE	57 28	98.6	77 30	21.1
	S	5 2 3	97.5	86 30	11.0
4	S 0° 20' E	2 47	97.3	86 10	11.1
	S 1° W	4 11	97.1	87 0	10.1
5	SSW	9 44	95.8	S 84 40 W	0.5
	SSW	10 36	95.6	84 30	0.1 W
6	SW	15 29	94.4	79 0	6.9 E
	SW			78 30	
7	WSW	20 34	93.2	76 0	10.6
	WSW			76 20	
8	S 88° W	23 4	92.6	76 40	10.6
	W			77 5	
9	N 69.°5 W	27 19	91.6	81 20	7.1
	N 67 W	27 56	91.4	81 40	6.9
10	NW	31 25	90.7	87 0	2.0 E
	NW			87 30	
11	N 24° W	33 50	90.1	N 85 30 W	4.6 W
	N 21 W	36 33	89.5	84 20	5.2
12	N 1.°5 E	42 51	88.0	76 20	11.8
	N 1.5 E			76 0	
13	NNE	47 45	87.0	68 40	18.2
	NNE			69 0	
14	NE	51 30	86.0	61 30	24.4
	NE			61 40	
15	ENE	55 46	85.0	55 30	29.6
	ENE			55 20	
16	E	58 59	84.3	51 10	33.0 W
	E			51 20	

$A = 0.°0$; $B = -21.°92$; $C = -0.°25$; $D = +2.°50$; $E = +0.°62$.

Ved denne og alle de følgende Bestemmelser var den forreste Jollebom om Bagbord svunget ud; i Husø var den svunget indover.

For this and all subsequent determinations, the foremost port davit was swung *out*, excepting at Husø, where it was swung *in*.

C	D	C	D	C	D	C	D
N	11.°6 W	E	33.°1 W	S	10.°5 W	W	10.°5 E
N 10° E	14.7	S 80° E	33.6	S 10° W	5.8	N 80° W	9.3
20	17.6	70	33.4	20	1.3 W	70	7.6
30	20.5	60	32.4	30	2.6 E	60	5.4
40	23.1	50	30.3	40	5.7	50	2.9
50	25.7	40	27.5	50	8.3	40	0.2 E
60	28.2	30	24.0	60	10.0	30	2.5 W
70	30.3	20	20.0	70	11.0	20	5.4
80	32.0	10	15.4	80	11.1	10	8.3

Middel af D = Misvisning = 11.°2 W. Mean of D = variation = 11.°2 W.

2. Bergen. **Byfjorden.** *(Bergen. The Byfjord.)* **1878. Juni 14.**

$\varphi = 60° 23.'9$ N. $\lambda = 5° 54.'0$ E. Greenwich.

No.	*C*	*t*	*a*	*S*	*D*
1	N 29.°5 E	5h 25m 47s	N 85.°2 W	N 61.°0 W	24.°2 W
2	S 79. W	37 49	82.7	82.0	0.7
3	S 58. W	41 10	82.0	80.5	2.5
4	S 37. W	44 0	81.4	75.5	5.9
5	S 17.5 W	47 11	80.7	69.0	11.7
6	S 1.2 W	49 13	80.3	62.7	17.6
7	S 8. E	51 20	79.8	53.7	26.1
8	S 68.5 E	54 52	79.1	42.5	36.6
9	N 88. E	57 20	78.6	43.0	35.6
10	N 58. E	6 0 17	77.9	47.3	30.6
11	N 35.7 E	2 16	77.5	52.0	25.5
12	N 9.7 E	4 29	77.1	56.7	20.4
13	N 3. W	6 18	76.7	59.8	16.9
14	N 36.5 W	9 53	75.9	67.0	8.9
15	N 68.7 W	13 42	75.2	74.0	1.2
16	N 89.5 W	17 8	74.5	72.8	1.7
17	N 69.5 W	19 52	73.9	70.5	3.4
18	N 55.2 W	22 19	73.4	67.2	6.2
19	N 48. W	25 26	72.8	64.8	8.0
20	N 20.5 W	28 14	72.2	59.0	13.2
21	N 11. W	30 21	71.7	57.0	14.7

$A = +0.°0;\ B = -17.°48;\ C = +0.°50;\ D = +2.°33;\ E = +0.°24.$

C	*D*	*C*	*D*	*C*	*D*	*C*	*D*
N	17.°6 W	E	36.°0 W	S	18.°2 W	W	1.°0 W
N 10° E	20.1	S 80° E	36.7	S 10 W	14.5	N 80° W	2.0
20	22.5	70	36.7	20	10.9	70	3.3
30	24.7	60	36.0	30	7.7	60	4.8
40	26.9	50	34.7	40	5.0	50	6.6
50	29.0	40	32.4	50	3.0	40	8.6
60	31.1	30	29.4	60	1.7	30	10.7
70	33.0	20	25.8	70	0.8	20	13.0
80	34.6	10	22.0	80	0.6	10	15.2

Middel af *D* = Misvisning = 18.°2 W. Mean of *D* = Variation = 18.°2 W.

3. Øst-Finmarken. *(East Finmark.)* 1878. Juni *(June)* 25.

$\varphi = 70° 45'.8$ N. $\lambda = 30° 6'.6$ E. Greenwich.

No.	C	t	a	S	D
1	S 45.°5 E	6h 20m 41s	N 77.°0 W	N 58.°6 W	18.°4 W
2	S 63.75 E	23 12	76.5	54.8	21.7
3	S 78.5 E	24 37	76.2	54.2	22.0
4	N 88.5 E	27 7	75.6	54.0	21.6
5	N 74.5 E	28 54	75.2	55.2	20.0
6	N 59. E	30 42	74.8	57.9	16.9
7	N 43.25 E	32 47	74.4	62.0	12.4
8	N 25.6 E	34 23	74.0	66.8	7.2
9	N 9.3 E	37 47	73.2	71.3	1.9 W
10	N 2.3 E	39 45	72.8	73.6	0.8 E
11	N 11. W	41 13	72.4	78.2	5.8
12	N 23.6 W	42 58	72.0	80.0	8.0
13	N 40.3 W	44 19	71.7	84.8	13.1
14	N 54.6 W	46 19	71.2	N 87.2 W	16.0
15	N 69. W	48 18	70.8	S 89.2 W	20.0
16	N 83.3 W	49 44	70.5	87.9	21.6
17	S 80. W	52 21	69.9	87.9	22.2
18	S 65.3 W	53 58	69.5	S 89.2 W	21.3
19	S 52.6 W	56 15	69.0	N 89.1 W	20.1
20	S 40.3 W	58 6	68.6	86.1	17.5
21	S 30.3 W	7 0 20	68.1	82.2	14.1
22	S 16.6 W	2 37	67.6	75.2	7.6
23	S 1.5 W	4 30	67.2	67.2	0.0
24	S 10.3 E	6 6	66.8	62.3	4.5 W
25	S 19. E	8 9	66.3	57.3	9.0
26	S 26.5 E	11 18	65.6	54.0	11.6
27	S 34.5 E	13 0	65.2	49.5	15.7 W

$A = +\ 0.°05$; $B = -\ 22.°22$; $C = +\ 0.°43$; $D = +\ 2.°30$; $E = +\ 0.°22$.

C	D	C	D	C	D	C	D
N	1.°2 E	E	21.°9 W	S	0.°1 W	W	22.°1 E
N 10 E	2.2 W	S 80 E	22.4	S 10 W	4.5 E	N 80 W	21.2
20	5.4	70	22.2	20	9.3	70	19.7
30	8.6	60	21.3	30	13.6	60	17.7
40	11.6	50	19.5	40	16.8	50	15.3
50	14.5	40	16.8	50	19.4	40	12.6
60	17.1	30	13.5	60	21.0	30	9.9
70	19.3	20	9.5	70	22.0	20	7.1
80	21.0	10	5.0	80	22.3	10	4.3

Middel af D = Misvisning = 0.°2 E. Mean of D = Variation = 0.°2 E.

4. Vest-Finmarken *(West Finmark).* 1878, Juli *(July)* 13.

$\varphi = 71^\circ\ 7'$ N. $\lambda = 21^\circ\ 11'$ E. Greenwich.

No.	*C*	*t*	*a*	*S*	*D*
1	N 89.° W	5^h 2^m 26^s	N 96.°2 W	N 112.°2 W	16.°0 E
2	N 71 W	4 49	95.6	108.8	13.2
3	N 43 W	7 52	94.9	100.8	5.9
4	N 24 W	9 21	94.6	96 5	1.9 E
5	N 2 E	11 56	93.9	90.1	3.8 W
6	N 22.5 E	14 39	93.3	82.4	10.0
7	N 45.5 E	16 35	92.8	74.0	18.8
8	N 65 E	20 5	92.0	67.4	24.6
9	E	22 8	91.5	64.0	27.5
10	S 67.5 E	25 51	90.6	63.5	27.1
11	S 45 E	28 9	90.1	66.1	24.0
12	S 23 E	31 34	89.2	72.4	16.8
13	S	33 55	88.7	82.0	6.7
14	S 0.5 W	35 15	88.3	82.0	6.3 W
15	S 22.5 W	37 44	87.7	93.0	5.3 E
16	S 43.5 W	39 20	87.4	101.0	13.6
17	S 67 W	41 46	86.9	103.0	16.1
18	N 89 W	45 55	85.9	102.0	16.1 E

$A = 0.^\circ0$; $B = -22.^\circ17$; $C = +0.^\circ22$; $D = +2.^\circ78$; $E = +0.^\circ05$.

C	*D*	*C*	*D*	*C*	*D*	*C*	*D*
N	5.°0 W	E	27.°6 W	S	6.°5 W	W	16.°3 E
N 10 E	8.0	S 80 E	28.0	S 10 W	1.3 W	N 80 W	14.9
20	11.0	70	27.8	20	3.6 E	70	13.0
30	14.1	60	26.7	30	8.2	60	11.2
40	17.2	50	25.0	40	11.8	50	8.5
50	20.2	40	22.5	50	14.4	40	6.0
60	22.9	30	19.4	60	16.3	30	3.5
70	25.1	20	15.6	70	17.0	20	0.7 E
80	26.7	10	11.3	80	16.9	10	2.1 W

Middel af *D* = Misvisning = 5.°6 W. Mean of *D* = Variation = 5.°6 W.

6. Sydkap, **Spidsbergen.** *(South Cape, Spitzbergen.)* **1878. August** ***(August)*** **5.**

$\varphi = 76° \, 27' \,$ N. $\quad \lambda = 17° \, 0'$ til $17° \, 10'$ E. Greenwich.

No.	*C*	*t*	*a*	*S*	*D*
1	N 89.°3 E	7ʰ 48ᵐ 47ˢ	N 59.°9 W	N 20.°0 W	39.°9 W
2	N 68.3 E	51 47	59.2	23.1	36.1
3	N 45.6 E	58 23	57.6	29.7	27.9
4	N 18.3 E	8 0 52	57.1	39.9	17.2
5	N 23 E	2 58	56.6	37.3	19.3
6	N 2.3 W	6 7	55.8	49.2	6.6
7	N 2 E	9 41 45	33.1	23.8	9.3
8	N 24.3 W	44 8	32.5	31.5	1.0 W
9	N 50.3 W	46 19	32.0	40.5	8.5 E
10	N 70 W	48 25	31.5	44.2	12.7
11	N 88.6 W	51 22	30.8	45.1	14.3
12	S 88.3 W	56 21	29.6	45.3	15.7
13	S 65 W	10 0 13	28.7	43.8	15.1
14	S 43.6 W	3 32	27.9	37.2	9.3
15	S 24.3 W	7 8	27.0	28.2	1.2 E
16	S 0.3 W	9 57	26.4	15.2	11.2 W
17	S 22.6 E	13 11	25.6	N 1.9 W	23.7
18	S 47.3 E	15 48	24.9	N 9.7 E	34.6
19	S 71.6 E	20 38	23.8	15.1	38.9
20	N 85.3 E	25 34	22.6	N 16.2 E	38.8

$A = + \, 0.°02; \; B = - \, 27.°67; \; C = + \, 0.°62; \; D = + \, 2.°47; \; E = + \, 0.°49.$

C	*D*	*C*	*D*	*C*	*D*	*C*	*D*
N	10.°5 W	E	39.°7 W	S	11.°5 W	W	16.°0 E
N 10 E	14.4	S 80 E	40.2	S 10 W	5.8	N 80 W	14.8
20	18.3	70	39.7	20	0.7 W	70	13.1
30	22.0	60	38.1	30	4.0 E	60	10.5
40	25.7	50	35.5	40	8.0	50	7.6
50	29.5	40	31.9	50	11.4	40	4.4
60	33.1	30	27.5	60	14.0	30	1.0 E
70	36.2	20	22.5	70	15.7	20	2.5 W
80	38.3	10	17.0	80	16.3	10	6.3 W

Middel af D = Misvisning = 11.°4 W. Mean of D = Variation = 11.°4 W.

7. Grønlandshavet. *(The Greenland Sea.)* **1878. August 9.**

$\varphi = 76° 27'$ N. $\lambda = 0° 56'$ W. Greenwich.

No.	*C*	*t* (a. m.)	*a*	*S*	*D*
1	S 56.°3 E	10ʰ 41ᵐ 53ˢ	S 21.°5 E	S 32.°0 W	53.°5 W
2	S 35 E	45 30	20.5	24.9	45.4
3	S 17.3 E	48 40	19.6	15.8	35.4
4	S 2 W	51 6	19.0	S 6.3 W	25.3
5	S 23.3 W	53 14	18.4	S 3.2 E	15.2
6	S 50 W	55 46	17.7	14.4	3.3 W
7	S 64.3 W	57 16	17.3	18.5	1.2 E
8	N 89 W	59 11	16.8	20.6	3.8 E
9	N 71 W	11 2 14	15.9	15.4	0.5 W
10	N 51.3 W	8 40	14.2	S 7.7 E	6.5
11	N 17.6 W	10 39	13.6	S 6.2 W	19.8
12	N 2 E	13 13	12.9	14.9	27.8
13	N 15 E	19 16	11.2	21.0	32.2
14	N 51.3 E	22 6	10 5	35.0	45.5
15	N 64.6 E	26 0	9.4	39.0	48.4
16	N 87 E	28 6	8.8	44.5	53.3
17	S 72.3 E	30 1	8.3	45.8	54.1
18	S 48.6 E	32 16	7.6	41.4	49.0
19	S 68.6 E	37 26	6.2	S 46.8 W	53.0 W

$A = -$ 0.°32; $B = -$ 28.°17; $C = -$ 0.°33; $D = +$ 2.°30; $E = -$ 0.°80.

C	*D*	*C*	*D*	*C*	*D*	*C*	*D*
N	26.°7 W	E	53.°7 W	S	26.°7 W	W	3.°6 E
N 10° E	30.5	S 80.° E	54.3	S 10° W	21.5	N 80° W	2.0 E
20	34.3	70	54.0	20	16.5	70	0.5 W
30	38.0	60	52.7	30	11.7	60	3.5
40	41.5	50	50.2	40	7.3	50	6.8
50	44.8	40	46.6	50	3.3 W	40	10.6
60	47.8	30	42.3	60	0.2 E	30	14.7
70	50.4	20	37.3	70	2.6	20	18.7
80	52.4	10	32.0	80	3.8 E	10	22.7 W

Middel af D = Misvisning = 25.°9 W. Mean of D = Variation = 25.°9 W.

Oversigts-Tabel. *(Synoptic Table.)*

Station.	Nordl. Bredde *(North Latitude)*	Længde fra Gr. *(Longitude)*	Datum *(Date)*	Klokkeslet *(Hour)*	Declination	Horizontal-Intensitet *(Horizontal Intensity)* Brit. Un.	Metr. Un.	m	Inclin. θ
Bergen	60° 23.'9	5° 24.'0 E	1876 Mai 22	1—2 p. m.		3.2238	1.4864	0.7666	
—				3—4½ p. m.					72° 24.'3
Husø	60 59.6	4 37.0 E	1876 Juni 10	4—6 p. m.	18° 19' W	3.1732	1.4631	0.7653	
—			— „ 12	10½—12 a. m.					72 43.4
—			— „ „	1½—2 p. m.					72 41.0
—			— „ „	6—7½ p. m.					72 43.9
—			— „ 13	10½ a.m.—7 p.m.	18 15 W				
—			— „ „	11—12 a. m.					72 46.0
—			— „ 15	12¼—1¾ p. m.		3.1751	1.4640	0.7650	
—			— „ „	2¼ p. m.		3.1750	1.4640		
—			— „ „	6¼ p. m.		3:1746	1.4637		
—			— „ „	7¼ p. m.					72 45.5
Do. Skjær *(Islet)*			— „ 16	11¼ a. m.	19 0 W				
— —			— „ „	12—1 p. m.		3.1686		0.7666	
— —			— „ „	2¼ p. m.		3.1734	1.4632		
— —			— „ „	6½ p. m.					72 44.8
— —			— „ „	7½ p. m.	18 2 W				
Husø			1877 Mai 23	5½ p. m.					72 43.4
—			— Juni 4	4—5 p. m.		3.1761	1.4644	0.7442	
Reykjavik	64 8.5	21 54.1 W	1876 Juli 28	5—6½ p. m.					76 28.5
—			— „ 29	5½ p. m.	38 19 W				
—			— „ 31	10—12¼ p. m.		2.6141	1.2053	0.7615	
—			— „ „	4—6 p. m.		2.6407	1.2176	0.7612	
—			— Aug. 1	1¼—2¼ p. m.					76 26.3
Namsos	64 28.2	11 31.5 E	1876 Aug. 18	11½—2 p. m.		2.9639	1.3666	0.7576	
—			— „ „	6 p. m.	13 43 W				
—			— „ 19	10½—11½ a. m.					74 2.3
—			— „ „	5—6 p. m.					74 2.3
Kristiania	59 54.7	10 43.6 E	1876 Oct. 2	11 a. —2 p. m.		3.4664	1.5983	0.7547	71 4.7
Bodø	67 17.2	14 24.9 E	1877 Aug. 13	9¾—11¼ a. m.					75 21.4
—			— „ „	12¼—5½ p. m.		2.7854	1.2842	0.7402	
—			— „ „	6 p. m.	11 41 W				
Tromsø	69 39.1	18 59.3 E	1877 Juli 11	11¾—12¾					76 21.9
—			— „ „	4—6¼ p. m.		2.6365	1.2155	0.7426	
—			— „ „	7 p. m.	10 18 W				
Hammerfest	70 40.2	23 40.4 E	1877 Juli 9	5¾—24 p. m.		2.5484	1.1750	0.7627	
—			— „ 10	10¾—12 a. m.					76 54.3
—			— „ „	12½ p. m.	5 29 W				
Vardø	70 22.4	31 7.8	1878 Juni 26	10¾—11½ a. m.					76 52.4
—			— „ „	1—6 p. m.		2.5737	1.1867	0.7616	
Bergen *(Bergen)*	60 23.8	5 17.1 E	1878 Juni 14	6 p. m.	18.°2 W				
Vestfjorden *(West Fjord)*	68 5	14 30 E	1877 Aug. 10	5½ p. m.	11.2 W				
Vest-Finmarken *(West Finmark)*	71 7	21 11 E	1878 Juli 13	5½ p. m.	5.6 W				
Øst-Finmarken *(East Finmark)*	70 45.8	30 6.6 E	— Juni 25	7 p. m.	0.2 E				
Norske Hav *(Norwegian Sea)*	75 3	5 13 E	— Juli 20	4½ p. m.	20.5 W				
Sydkap Spidsbergen *(South Cape Spitzbergen)*	76 27	17 5 E	— Aug. 5	10 p. m.	11.4 W				
Grøndlandshavet *(Greenland Sea)*	76 27	0 56 W	— „ 9	11 a. m.	25.9 W				

H. Mohn. Nogle Bidrag til de nordlige Landes Geografi og Naturhistorie,

sammenstillede efter Iagttagelser, gjorte paa den norske Nordhavs-Expedition 1876—78.

Med 6 farvetrykte Billeder og 9 Træsnit samt 2 Karter.

Ved Nordhavs-Expeditionens Ophold i Havn eller under Kysten af de af det nordlige Atlanterhav og Ishavet beskyllede Lande og Øer, søgte man, saavidt Lejligheden tillod det, at anstille forskjellige Slags Iagttagelser paa Land. Disse Iagttagelser og deres Resultater har jeg, forsaavidt de antages at indeholde nye Oplysninger af Interesse, sammenstillet i de følgende Blade. De medfølgende Billeder, der samtlige ere udførte efter Originaltegninger, tagne paa Stedet, ville i mange Henseender give en langt fuldstændigere Forestilling om Gjenstandene end den vidtløftigste Beskrivelse.

I. Vestmanna-Øerne.

Fra Reden udenfor Havnen, hvor "Vöringen" laa fra den 22de til den 26de Juli 1876, ser man mod Nord Heima-Øens højeste Fjeld, *Heimaklettur*,* og mod Nordost Forbjerget *Ystiklettur*. Det er dette sidste, vi se paa Billedet, til hvilket Maleren, Hr. Schiertz, har benyttet sin fortrinlige, paa Stedet tagne Farve-Skitse. De vulkanske Bergarters Forvitringsformer i dette fugtige Klima illustreres udmerket vel paa dette Billede. *Ystiklетturs* stejle Vægge med sine smale Afsatser gjør det til et Fugleberg, hvor den hvide fra Fuglene hidrørende Farve smukt vexler med den naturlige brune, og oventil ser man paa mindre og større Partier den for Nordvest-Europas Ølande ejendommelige saftige grønne Farve af Græsset. Ved Klettens

H. Mohn. Contributions to the Geography and Natural History of the Northern Regions of Europe,

derived from observations made on the Norwegian North-Atlantic Expedition (1876—1878).

With 6 Chromo-lithographs, 9 Wood Engravings. and 2 Maps.

The time passed by the Norwegian Expedition on the coast of such continental tracts and islands as border upon the North-Atlantic and the Arctic Ocean, was devoted, circumstances permitting, to the prosecution of exploratory work on shore. Those of the observations, and their results, that are fraught, it is presumed, with new and interesting data, have been set forth in the following pages. The accompanying illustrations, all of which are from sketches taken on the spot, will convey, in many respects, a much livelier impression of the natural objects they represent than any mere verbal description, however graphic and precise.

I. The Vestmanna Islands.

From the roadstead, without the harbour, where the "Vøringen" lay at anchor from the 22nd to the 26th of July 1876, is seen, looking north, Heima Island's loftiest summit, *Heimaklettur*, and north-east, Cape *Ystiklettur*. It is the latter we have depicted in the plate, for the original of which Mr. Schiertz, artist to the Expedition, made good use of his admirable water-colour sketches, taken on the spot. The rugged forms assumed in this humid climate by the disintegrated volcanic rocks are faithfully rendered. *Ystiklettur*, with its precipitous walls and long, narrow ledges, exhibits the salient features of a fowling-cliff, where the white colour characteristic of bird-haunts is picturesquely blent with the natural brown of the rock; and here and

Fod sees en Hule i Havbrynet; den benævnes *Klettshellir,* og er et af de mange Vidnesbyrd om Havets Virkninger paa Kysterne, paa hvilke Færøernes og Islands Klippestrande ere saa rige. Taagen ligger over Havet og stenger Udsigten til Island selv, med de store Jøkler.

Vende vi fra Ankerpladsen Blikket rundt, saa se vi mod Syd eller Sydvest den lille, men regelmæssige, nu udslukte Vulkan *Helgafell.* Den 23de Juli 1876 gjorde jeg, i Følge med Distriktslægen, Thorsteinn Jonsson, en Tur til Toppen af Helgafell. Vejen gik først over en udstrakt Lava-Mark, *"hraun"*, der skraaner nedad fra Vulkanens Kegle. I denne Lava findes flere Huler. En af dem er sine 20 Meter lang og 10 Meter bred; ovenfra kommer man ned i den gjennem et lidet Hul, gjennem hvilket man kan hoppe ned paa Bunden. I en Højde af omtrent 124 Meter over Havet ophørte Lavamarken og afløstes af den øverste Vulkan- eller Aske-Kegle. Denne bestaar af udkastede løse Masser, tildels af større Dimensioner, som Lavablokke af indtil 1 Meters Længde, men hovedsagelig af mindre, aflangt runde, rødlige Slaggestene og endnu mindre, mørke Smaasten og Sand.

Paa Toppen af Helgafell er der en kraterformet Fordybning. Den største Højde af Krater-Randen ligger mod Sydost, den laveste mod Nordvest. Forskjel i Højde c. 12 Meter. Kraterets Bund ligger igjen omtrent 12 Meter lavere end Randens laveste Parti. Keglens ydre Skraaning har en Heldning af c. 35°. Den er kortest paa Sydsiden, hvor de løse Materialier ikke række saa langt ned som paa Nordsiden, og fra hvilken Side derfor ogsaa Bestigningen er lettest.

Højden af det Punkt, hvor Keglen rækker længst ned paa Nordsiden og hvor Lavamarken begynder, samt Højden af den højeste Kam paa Helgafells Krater er beregnet efter Observationer med Aneroidbarometer. Dette sammenlignedes med Observationerne ombord (der udførtes hver Time), idet jeg aflæste det ved Havfladen før og efter Opstigningen. Desuden anbragtes de ved Undersøgelsen paa det meteorologiske Institut bestemte Correctioner for forskjellige Højder. Luftens Temperatur maaltes med Slyngethermometer. Ved Stranden var den 0.°2 til 0.°3 højere end ombord i "Vøringen". De til Normalbarometer og Normalthermometer reducerede observerede Værdier vare:

there at the summit the eye rests refreshed upon grassy patches of the rich bright-green tint peculiar to the island herbage of north-western Europe. At the foot of the cliff we see a cave, called *Klettshellir;* it is one of the striking proofs given by the sea of its action on coasts, of which so many are to be met with along the rocky shores of the Færoes and Iceland. A mist lies over the ocean, shutting out from view the main land of Iceland, with its great glaciers.

Bearing south, or rather south-west, from the anchorage, we have the small, but in form regular, and now extinct volcano *Helgafell.* On the 23rd of June, 1876, I made an excursion to the top of this mountain, in company with the surgeon of the district, Mr. Thorsteinn Jonsson. The way led at first over a broad expanse of lava, *hraun,* shelving down from the cone of the volcano. In the lava are a number of caves. To one of these, measuring 60 feet in length by 30 in width, access is gained from above through a narrow opening, down which you can leap to the bottom. The field of lava reaches about 370 feet above the sea, as far as the upper cone of the volcano. This cone consists partly of loose ejected masses, for instance blocks of lava measuring as much as 3 feet in length, but chiefly of reddish oval-shaped cinders, along with dark-coloured pebbles and sand.

At the summit of Mount Helgafell there is a craterlike excavation. The height of the edge is greatest towards the south-east, least towards the north-west, the difference being about 40 feet. The bottom of the excavation lies about 40 feet beneath the lowest part of the edge. The outer slope of the cone inclines at an angle of circa 35°. It is shortest on the south-side, where the loose debris do not extend so far down as on the north, and up the southern acclivity the ascent of the mountain is therefore easiest.

The altitude of the lowest point to which the wall of the cone descends on the north side, viz. where the field of lava begins, as also of the loftiest ridge of the crater, was computed from observations with the aneroid barometer. The readings of the instrument at the level of the sea, which I noted before and after the ascent, were compared with the observations on board, taken every hour, and the corrections found at the Meteorological Institute for different altitudes duly applied. The temperature of the atmosphere was taken with the sling thermometer. Along the shore it was from 0.°2 to 0.°3 higher than on board the "Vøringen." The observed values reduced to those of the standard barometer and standard thermometer, were as follows: —

1.	Foden af Keglen *(Foot of Cone)*	Kl. 7h 6m p. m.	Bar. reduc. 736.mm7	Temp. 8.°5 C.
	Havfladen *(Sea-level)*	„ „ —	— — 747. 9	— 9. 5
	Resultat. Højde *(Result. Height)* = 124 Meter *(Metres).*			
2.	Toppen af Helgafell *(Summit of Helgafell)*	Kl. 7h 22m p. m.	— — 726. 35	— 6. 7
	Havfladen *(Sea-level)*	„ „ —	— — 747. 9	— 9. 4
	Resultat. Højde *(Result. Height)* = 240.5 Meter *(Metres).*			

2. Jan Mayen.

Den 27de Juli 1877, om Aftenen, kom vi, paa Vejen fra Tromsø til Jan Mayen, ind i Polarstrømmen. Temperaturen i Havets Overflade, der hele Dagen tidligere havde været 8° og derover, gik hurtig ned til mellem 4° og 5° og en Temperatur af 0° fandtes allerede i 17 Favnes Dyb. Dette var 15 geografiske Mil øst for Jan Mayen. Den følgende Nat og Formiddag dampede vi, under jevnlig Lodning, videre vestover og fandt Dybder paa 829, 968, 796, 1060 og, Kl. 1 Eftm. den 28de, 654 Favne. Endnu viste Jan Mayen sig ikke. Med det kolde Vand havde Polarhavets Taage indfundet sig og taget bort saavel Solen som al Udsigt til Land. Imidlertid tydede, foruden Dybdens Aftagen, den stadig tiltagende Mængde af Søfugl, navnlig Lunder, som saaes flyvende østover, paa at Landet ikke kunde være langt borte. Med Kursen fremdeles ret mod Vest dampedes fra Pladsen for det sidste Lodskud videre Kl. 1.40 Min. Kl. 2 hørtes pludselig første Styrmands Raab "Jeg ser Isbræen forud". Farten standsedes. Loddet kastedes og viste en Dybde af 144 Favne. I Horizonten, under den lavt liggende Taage, skimtedes en vældig nedoverhængende Isbræ mod den mørke Fjeldvæg. Det var Østsiden af Jan Mayen. Med Loddet i Bund bleve vi liggende paa samme Plads et Par Timers Tid. Taagen lettede noget, og vi kunde se nordover til Ostkap og sydover til Sydostkap. Vi laa ligeudenfor den sydligste af Østsidens fem store Isbræer (Petersens Bræ). Afstanden fra Land bestemtes, ved Ekkoet af et Kanonskud, (10.'4 Mellemtid) til en liden Kvartmil (1750 Meter).

Da Søgangen kom fra Nordnordost og der saaes Brændinger paa Stranden, besluttedes det at søge en Ankerplads paa den anden Side af Øen. Vi tog da Loddet ind og dampede nordover. Vejret holdt sig fremdeles taaget, og i det Øjeblik, vi vare naaede til tvers af Nordostkap, lagde Taagen sig saa tæt over Havet, at Landet og Horizonten blev taget ganske bort. Kursen sattes en Stund senere mod Vest, derpaa mod Syd og endelig mod Sydost. Taagen holdt sig hele Tiden over Havet og hindrede al Udsigt. Med korte Tidsmellemrum observeredes Havoverfladens Temperatur som et muligt Varsel om Is i Nærheden. Vi fandt jevnlig over 3°, og ikke lavere end 2.°3. Da vi Kl. 7 om Aftenen efter Bestikket nærmede os Mary Muss Bugten, begyndte vi at lodde, og fortsatte hermed under Farten ind mod det usynlige Land, for paa denne Maade at finde en Ankerplads, til Kl. 10. Kl. 10½ begyndte imidlertid heldigvis Taagen at løfte sig, saaat de nedre Dele af Landet bleve synlige. Vi kunde nu orientere os og vælge vor Ankerplads, og Kl. 11 faldt Vøringens Anker i Mary Muss Bugten paa 20 Favne Vand, en god halv Kvartmil fra Stranden.

2. Jan Mayen.

In the evening of the 27th of July, 1877, on our passage from Tromsø to Jan Mayen, we entered the Polar current. The temperature at the surface of the sea, which throughout the day had not been lower than 8°, sank rapidly to between 4° and 5°, and 0° was registered at a depth of 17 fathoms, the position of the ship being then 60 miles east of Jan Mayen. During the night and the forenoon of the following day we steamed on westward, sounding repeatedly, and found the depth to be successively 829, 968, 796, 1060, and, at 1 p. m. on the 28th, 654 fathoms. Still, nothing was to be seen of Jan Mayen. With the frigid water had come the Arctic fog, shrouding both the sun and the land. Meanwhile, divers species of sea-birds, more especially puffins, seen flying eastward in steadily increasing numbers, could not fail to announce, apart from the observed decrease in depth, our comparative proximity to the island. Steering due west as before, we steamed on from where the last sounding had been taken (1.40 p. m.), and at 2 p. m. we suddenly heard the first mate shout "Glacier ahead!" The ship's way was immediately deadened, and on heaving the lead, the depth was found to be 144 fathoms. On the horizon, under the low-lying fog, could be descried against the dark mountain-wall a huge, beetling glacier. It was the eastern shore of Jan Mayen. With the lead at the bottom, we remained in the same spot for a couple of hours, when the fog began to clear a little, and looking northward, we could sight Cape East, southward, Cape South-East. The vessel lay right off the most southerly of the 5 large glaciers (Petersen's glacier) on the east coast of Jan Mayen. The distance from land was determined by the echo of a cannon-shot (interval 10.'4), and found to be something under a mile (5742 feet).

The swell coming from the north-north-east, and observing the sea breaking on the shore, we determined to seek a sheltered anchorage on the other side of the island. The lead was accordingly hoisted in, and we steamed northward. The weather still continued thick; and just as the vessel had got abreast of Cape North-East, the fog became all at once so dense that nothing could be seen of the land and the horizon. Shortly after, the course was set west, then south, and finally south-east. Meanwhile, there was no break in the fog, which still hung over the sea, excluding the prospect on every side. At brief intervals we noted the temperature of the surface-water, as a possible indication of the proximity of ice. This was generally found to be 3°, and in no case under 2.°3. At 7 p. m., as, according to our reckoning, we were approaching Mary Muss Bay, we heaved the lead, and continued sounding till 10 o'clock, as we bore down on the fog-shrouded coast to find anchorage for the ship. Fortunately, however, at half-past ten the dense mist began to rise, disclosing the lower parts of the land. We could now look about us and choose our anchorage; and at 11 o'clock the "Vøringen" dropped her anchor in Mary Muss Bay, in 20 fathoms of water, a little more than half a mile from the shore.

Den følgende Morgen var Havet aldeles roligt. Taagen laa fremdeles over Landet, saaat kun de lavere Dele vare synlige, til en Højde af 150 til 200 Meter. Foran os laa det maleriske Fugleberg (Fig. 1), hvis bratte, mørke Vægge mindede om Ystiklettur paa Vestmannaøerne. Ved

The next morning the sea was quite calm, but a thick fog, at the height of 500—600 feet, still hung over the island, only the lower range of coast being accordingly visible. In front towered the "Fugleberg," or fowling-cliff (Fig. 1), which with its dark, precipitous rocks vividly

Fig. 1. Fugleberget. — The Fugleberg, or Fowling-Cliff.

Siden af Fugleberget, længere mod Syd, laa en flad Sandstrand, tæt bestrøet af Rækved. Her gik vi i Land uden den ringeste Vanskelighed. Stranden bestod af sort Sand. Den største Del af Rækveden laa paa en fra Havbredden noget tilbagetrukket Slags Terrasse, hvis horizontale Flade fandtes 5 til 6 Meter over Havets Niveau. Den mindre Del laa paa den foranliggende Skraaning mellem Terrassen og Stranden. Derfor ser det i Frastand fra Søen ud, som om Rækveden laa opstablet i regelmæssige Lag paa Stranden.

"Fugleberget" viste sig at være — som det sees af Figur 1 — Østsiden af et Krater, hvis vestlige Del er styrtet i Havet. Det er bygget af Lag af Tuf, fast Lava, udkastede Masser af Slakker og Aske. Paa den søndre Side af Mary Muss Bugten hævede sig, nær Søen, et mindre kegleformigt Krater (Krater Blytt), og indenfor dette, nærmere Øens Midte, et noget større af samme Form (Krater Danielssen), hvis Top nu ragede op i Taagen, men som

reminded us of Ystiklettur on the Vestmanna Islands. Stretching south of the Fugleberg, lay a flat sandy beach, bestrewn with driftwood. Here we landed, without the slightest difficulty. The beach was of black sand. Most of the driftwood lay on a terrace-like ledge, the level surface of which extended from 15 to 20 feet above the sea; the remaining portion was scattered over the gentle slope between the ledge and the beach. Thus, from the sea the driftwood appears at some distance to be piled along the shore in regular layers.

The "Fugleberg" (see Fig. 1) was found to be the eastern side of a crater whose west part had toppled down into the sea. It is built up of stratified tuff, compact lava, discharged masses of cinders, and ashes. On the south shore of Mary Muss Bay, in close proximity to the sea, rose a smaller, conical-shaped crater (Blytt's crater), and farther inland, towards the middle of the island, another of similar form, but somewhat larger (Danielssen's crater),

en af de følgende Dage saaes klart fra Øens Østside. Ved at stige op saa højt som Taagen tillod mig (175 Meter), fandt jeg Keglen bestaaende af lutter løse, udkastede, afrundede røde Stene samt sort Aske.

Ved Opstigningen fra Mary Muss Bugten naaede jeg, mellem Fugleberget og de to nævnte Kratere, meget snart op til Højderyggen af Øen, der her er paa sit laveste og smaleste. Fast lysgraa Lava, jevnlig blæret i Overfladen, dannede her Bergarten. Denne er, ifølge en senere Undersøgelse,[1] i meget ringe Grad, næsten umerkelig, magnetisk, medens en tættere, mørkere Lava, med indesluttede større Krystaller af indtil flere Millimeters Gjennemsnit og af basaltisk Udseende, der fandtes paa flere Steder, er tydelig polar magnetisk. Det laveste Parti af denne Højderyg fandtes efter Maaling med Aneroidbarometer at være 66 Meter. Højderyggen afluttedes paa den anden Side, mod Sydost, af en brat Styrtning. Under denne laa et udstrakt lavt Forland, der danner den indre Begrændsning af den lange, østlige Lagune. Mod Øst saaes fra Højden

its summit shrouded in mist, of which however we got on one of the following days an excellent view from the east side of the island. On clambering up as far as the fog would admit (570 feet), I found the cone to be exclusively composed of reddish, rounded, cindery stones ejected from the crater, and ashes.

Making the ascent from Mary Muss Bay, I soon reached — between Fugleberg and the two above-mentioned craters — the chief mountain ridge of the island, where its breadth and altitude are least. Here, compact light-grey lava, cellular at the surface, constitutes the outer stratum of rock. According to a subsequent examination,[1] this substance is very slightly, nay well-nigh inappreciably magnetic, whereas a denser, darker-coloured lava containing large crystals, — some of which measure several millimetres in diameter, — and of basaltic appearance, that occurred in several localities, has a perceptible magnetic polarity. The least elevated section of the ridge was found, from observations with the aneroid barometer, to reach an altitude of 217 feet. The ridge terminates on the opposite side of the island, towards the south-east, in a

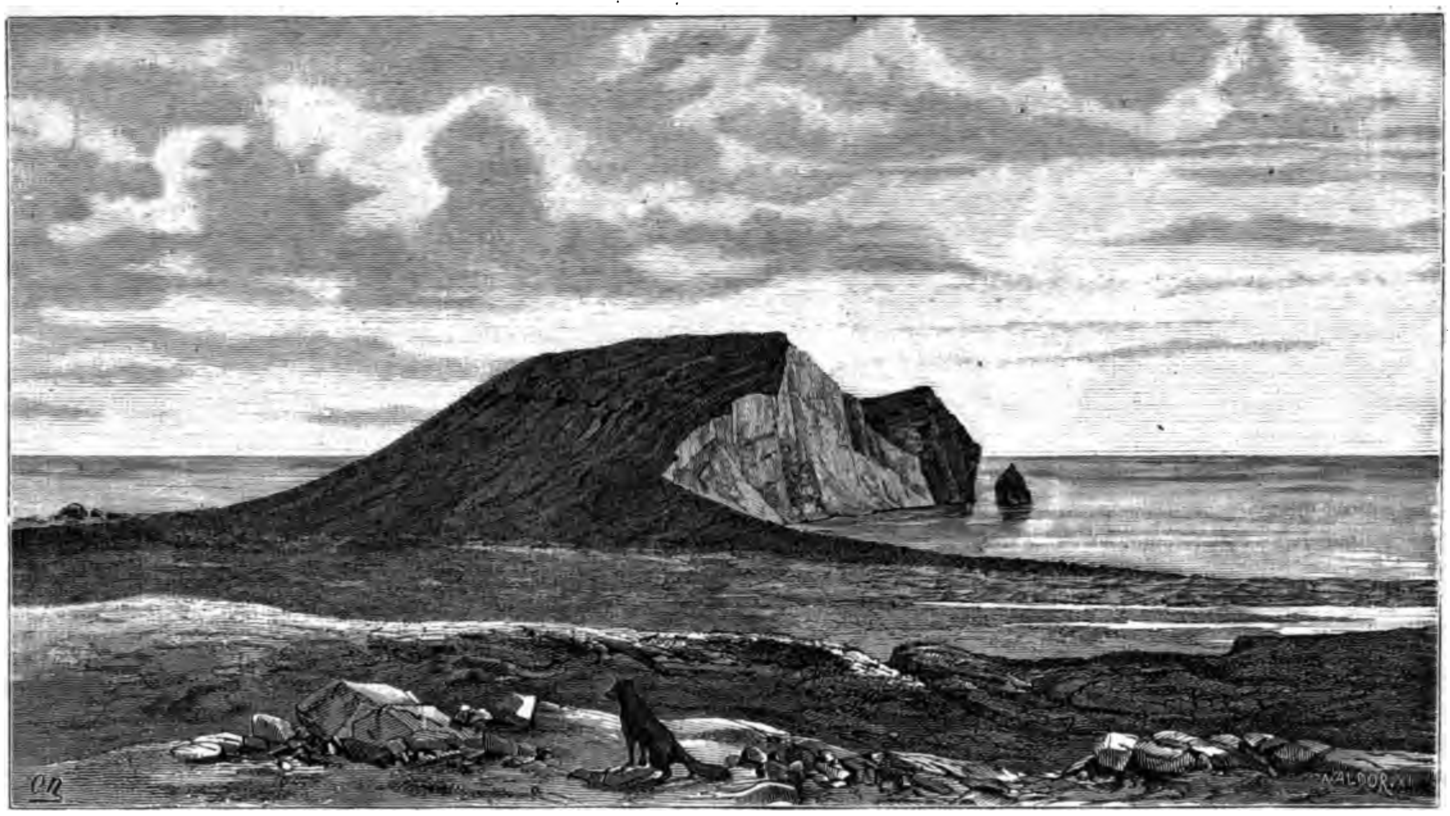


Fig. 2. Ægøen. — Egg Island.

[1] Foretaget af Prof. Schiötz.

[1] By Professor Schiötz, of Christiania University.

den i Havet udstikkende Halvø "Ægøen" med sin "Kalv" (Fig. 2). Mod Sydost saaes under Taagen Jan Mayens Syd-Lands Østkyst, med Lagunen og dens Vold, og de frit staaende af Havet opragende Bergknauser "Lodsbaaden" og det fjernere "Fyrtaarnet". Hr. Schiertz's Billede giver en udmerket Forestilling om dette Parti. Til Grund for samme ligger en Skitse taget fra Højderyggen. Da Taagen, som nævnt, denne Dag dækkede Højderne, ere disse tilføjede efter de fra Ankerpladsen paa Østsiden et Par Dage senere tagne Skitser.

Mod Nord kunde ingen fremtrædende Træk i Landskabet sees under Taageranden. Paa Tilbagevejen til Landingspladsen fulgte jeg en liden Bæk mellem de to nævnte Kratere i Syd for Mary Muss Bugten. Den forsvandt i Sandet førend den naaede Havet. Fra dette Punkt tegnede jeg Skitsen til Fig. 1, der viser "Fugleberget" fra Siden, til Venstre af samme Havet, til Højre den vestlige Lagune.

Samme Formiddag samlede Dr. Danielssen Planter paa Højderyggen og paa Skraaningen af det større Krater (Krater Danielssen) i Syd for Landingspladsen. En Polarræv, der blev opjaget paa Højderyggen eller Ejdet, blev skudt med Expressrifle af Lieutenant Petersen.

Det rolige Vejr vedvarede om Eftermiddagen, og nye Excursioner foretoges i Land. Fra Landingspladsen gik jeg først over den indre og ydre Skraaning af Fuglebergets Affald mod Sydost, og derpaa tilvenstre i Dalen indenfor Fugleberget, indtil jeg naaede den vestlige Lagune. For at komme fra Lagunens sydlige Strand hen til den Tange, som skiller den fra Havet, maatte jeg passere en Ur af tildels store skarpkantede Lavablokke, der her danner Overfladen af "Fuglebergets" mod Lagunen vendende Fod. Lagunen har ferskt Vand. Den er saa dyb, at Bund ikke kunde sees paa en kort Afstand fra Stranden.

Tangen, som skiller Lagunen fra Havet, var 200 Skridt (140 Meter) bred. Dens højeste Ryg laa, efter Maaling med Aneroidbarometer, 8 à 9 Meter over Havets Niveau. Lagunvandets Niveau laa 5 à 6 Meter under Tangens Ryg, eller omtrent 3 Meter højere end Havets Niveau. Paa Tangen laa megen Rækved og mange Hvirvler og Kjæver af Hval. Der fandt jeg ogsaa et Flotholt, c. 10 Cm. langt, 7 Cm. bredt, 2 Cm. tykt, af Bark. Forskjellige Stykker bredbladet Tang laa opskyllede paa Yderkanten af samme Vold. Dennes Længde ansloges til en Kvartmil og Lagunens Bredde til henimod det samme. Der saaes Rækved liggende ogsaa paa Lagunens søndre,

steep declivity, beneath which stretches a broad expanse of low-lying foreshore, forming the inner boundary of the long eastern lagoon. Looking east from the heights above, I had before me the "Ægøen" (Egg-Island) peninsula, with its "calf" — small detached islet (Fig. 2). In the south-west, we could sight beneath the fog the east coast of the southern part of Jan Mayen, with the lagoon and its barrier, and, rising abruptly from the sea, two isolated rocks, known as "Lodsbaaden" (the pilot boat) and "Fyrtaarnet" (the lighthouse). Mr. Schiertz has given in the plate an excellent view of this fine coastal scenery, sketched from the ridge overlooking the sea. The mountain summits having, as previously remarked, been wrapped in clouds on our arrival, that part of the picture was filled in from sketches taken a day or two later from our anchorage on the east side of the island.

North, no prominent feature of the scenery could be discerned below the fog. On my way back to the landing-place, I followed the course of a rivulet between the two craters south of Mary Muss Bay. Before reaching the sea, this little stream was lost in the sand; and here I sketched the "Fugleberg" — a side-view, to the left the ocean, to the right the western lagoon (Fig. 1).

The same afternoon Dr. Danielssen collected specimens of the insular flora on the mountain ridge and on the slope of the great crater (Danielssen's crater), south of the landing-place. A polar fox, roused, I believe, among the rocks of the mountain ridge, or on the isthmus, was shot by Lieutenant Petersen with an "Express" rifle.

The weather still continuing fine, further excursions were made in the afternoon. From the landing-place I took a south-easterly direction, crossing the south-western ridge of the Fugleberg, and then, turning to the left, struck off down the valley on the shore-side of the cliff, till I came to the western lagoon. In making my way from the south shore of the lagoon to the strip of land stretching between it and the sea, I had to pass an incline of debris over part of which were dispersed large, sharp-edged blocks of lava, that hereabouts form the base of the fowling-cliff on the side facing the lagoon. The water of the lagoon is fresh, and apparently of considerable depth, since the bottom could not be discerned at a short distance from shore.

The barrier separating the lagoon from the sea measures 200 paces (460 feet) across. Its highest ridge, as determined from observations with the aneroid barometer, attains an elevation of 28 feet above the level of the sea. The surface of the water of the lagoon lies 18 feet lower than the ridge of the barrier, or about 10 feet above the level of the sea. On the barrier there was a good deal of driftwood, along with the vertebræ and jaws of whales. There, too, I found a float of bark, about 4 inches long, 3 inches broad, and $^3/_4$ inches thick. Divers fragments of broad-leafed seaweed had been washed on to the outer slope of the barrier. The length of the latter

indre Strand. Luftens Temperatur var 4° og Vandet i Lagunen var + 4.°3.

Under Tilbageturen sad min Ledsager, der havde Hagelgevær med, og jeg og hvilede i Uren ved Lagunens Bred. En Ræv kom frem af Uren, betragtede os nysgjerrig, gik oven om rundt om os og saa udover Lagunen. Paa mit Vink havde imidlertid min Ledsager ladet Geværet og rakt mig det. Blandt de fra denne Excursion medbragte Specimina var et i Uren skudt Exemplar af *Canis lagopus*. Det 3die Exemplar blev skudt af Capt. Wille samme Eftermiddag paa Stranden i Mary Muss Bugten, hvor Matroserne havde opgjort et Baal af Rækved, der syntes at hidlokke Rævene.

Hr. Tornøe gik samme Eftermiddag langs den indre Side af Lagunen. Ved dens nordøstre Hjørne fandt han

I estimated at an English mile, and took the breadth of the lagoon to be about the same. Driftwood lay scattered over the southern (inner) strand of the lagoon. The temperature of the air was 4°, that of the water in the lagoon 4.°3.

On our way back to the boat, as I and my companion, who carried a fowling-piece, were resting on the tract of debris that borders the shore of the lagoon, a fox made its appearance among the stones, and, after regarding us a moment with evident curiosity, passed quietly on, within good range, in a circuit above us, and looked out across the lagoon. I motioned my companion to load and hand me the gun. Among the specimens collected on this excursion was an example of *Canis lagopus*. Another specimen of this animal was shot the same afternoon by Capt. Wille on the shore of Mary Muss Bay, where the sailors had lighted a pile of driftwood, which seemed to attract the foxes.

Mr. Tornøe strolled along the land-side of the lagoon, flowing into which, at the north-eastern extremity, he found

Fig. 3. Det Brielske Taarn. — Brielle Tower.

en Bæk (Tornøes Bæk), der løb ud i Lagunen. Fra den søndre Strand af Lagunen førte en lavtliggende Dal, kanske det laveste Ejd paa hele Øen, ham over til Østkysten, hvor han steg ned ad den bratte Skraaning og vandrede hen til

a small stream (Tornøe's rivulet). From the south side of the lagoon, a deep-lying valley, perhaps the lowest part of the island, took him across to the eastern shore, whence, descending the steep incline, he made his way to the long

den lange Lagune. Ogsaa her var Vandet ferskt, men Lagunen var meget grundere end Vestsidens. Der laa Rækved, saavel paa Lagunvolden som paa den indre Strand.

Den følgende Dag arbejdede Zoologerne med Skrabning fra Baad i Mary Muss Bugten. Fra vor Ankerplads toges Skitser, navnlig af Landet mod Vest. Disse ligge til Grund for Fig. 3, der viser Udseendet af det Nes, der begrændser Nordostsiden af Nord-Baj eller English Bay. Yderst ser man den isolerede høje Klippe, som af de gamle Hollændere er kaldt "Brielle-Taarnet" og som danner et udmerket Sømerke. Mellem "Taarnet" og Landet indenfor er en dyb Kløft, som paa de ældste Karter kaldes "Walrusch Gat". Billedets Synspunkt er tænkt paa den vestlige Laguntange, strax i Nordost for Fugleberget, hvis bratte Skrænt sees til venstre i Forgrunden. Brielle Taarnet ligger tre Gange saa langt borte som "Vøringen".

Da vi om Eftermiddagen gjorde os istand til at gaa i Land for at undersøge Landet længere sydpaa, rejste sig en frisk Bris af Nordvest, der satte saa megen Sø, at Landgang blev vanskelig. Det besluttedes da at sejle om til den anden Side af Øen. Under Letningen kom Solen et Par Gange frem i Vest, saa at dens Højde kunde maales. Paa den anden Side, mod Nordost, rev Vinden enkelte Gange Hul i Taagen, og Toppen af Beerenberg viste sig i nogle Secunder, ophøjet og vidunderlig skjøn, i sin blændende hvide Snekaabe. Dens Højde blev maalt med Sextant. Vi styrede NNV. over. Saa ofte som Beerenberg var synlig, benyttedes de korte Stunder til at fæste dens Udseende i Skitsebøgerne. Efter disse Skitser er Fig. 4 tegnet. Forholdet mellem de verticale og horizontale Udstrækninger er det rigtige og stemmer med Kartet. Store sorte Flekker, paafaldende mørke ved Contrasten med den blændende hvide, af Solen oplyste Sne, viste bratte Styrtninger paa den øvre Kegle, hvor Fjeldet var ganske bart. Da vi kom længere frem, stak to Afsatser, den ene udenfor (nordenfor) og nedenfor den anden, sig frem mod Nord — se Fig. 4 — saa kom Taagen og tilhyllede atter alt undtagen det laveste af Landet til 90 à 100 Meters Højde.

Under hele Farten denne Eftermiddag og Aften rundt Øens Nordende toges stadig Pejlinger med Compasset til alle synlige Pynter og andre merkelige Gjenstande, og der maaltes Vinkler med Sextant. Ogsaa til Punkter paa Sydlandet, der under den første Del af Farten saaes helt nede indtil Hoyberg, toges Sigter. Kursen styredes og beregnedes med Nøjagtighed og Loggemaskinen observeredes hvert femte Minut. Der toges ved Siden heraf en Række Skitser. Det saaledes indvundne Materiale er i fuldt Maal

lagoon. Here, too, the water was fresh, though the lagoon was much shallower than that on the west side. Driftwood lay scattered alike on the barrier and on the inner strand.

On the following day our zoologists dredged from a boat in Mary Muss Bay. Sketches were made from the anchorage, chiefly of the land stretching west; and these have furnished the subject of Fig. 3, which gives a view of the headland forming the north-eastern extremity of North or English Bay. In the distance is seen the lofty isolated rock called by the early Dutch navigators "Brielle Tower," and which serves as an excellent land-mark. Between the "Tower" and the main land extends a deep ravine, that bears on the earliest maps the name of "Walrusch Gat." The point of view in the figure is supposed to be on the barrier of the western lagoon, north-east of the Fugleberg, which, with its steep acclivity, rises boldly in the left foreground. The distance of Brielle Tower from the point of view is thrice that of the "Vøringen."

In the afternoon, as a party of us were getting ready to go ashore, with a view to explore the island farther south, a fresh breeze sprang up from the north-west, and soon made so rough a sea that landing was out of the question. We determined therefore to steam round to the opposite side of the island. While getting under weigh, the sun broke out twice in the west, and we managed to take a couple of altitudes. Now and again, on the other side, in the north-east, the wind tore a rent in the clouds, and for a few seconds disclosed the dazzling, snow-capt summit of Beerenberg, in matchless grandeur and beauty. The height of the mountain was measured with the sextant. We steered north-north-west. So often as any part of Mount Beerenberg became visible for a moment, the brief opportunity was eagerly seized to fix some new feature of its fleeting aspect. Fig. 4 is from these sketches. The proportion between the vertical and the horizontal extent of the mountain is true to nature, and agrees with the Map. Huge black patches on the upper cone, rendered doubly conspicuous by contrast with the dazzling white of the sun-illumined snow, showed the position of the steepest inclines, where the mountain was entirely naked. Farther on, two rocky ledges, the one beyond (north of) and below the other, could be seen projecting northward (Fig. 4); — and then came the fog, blotting out everything from view, save the lowest strip of coast, that was still visible for about 300 feet above the sea.

During the whole of that afternoon and evening, as we steamed round the northern extremity of the island, bearings by the compass were successively taken of all visible headlands and other salient landmarks; and angles were measured with the sextant. Of points on the south part of Jan Mayen, that for some time after starting could be seen as far as Hoyberg, bearings were also taken. The ship's course was accurately computed, the water-log being observed every five minutes. Moreover, a series of sketches

blevet benyttet til Constructionen af det medfølgende Kart.

Paa Vestsiden af Beerenberg saaes nedimod Havet enkelte Sneklatter, men nogen Isbræ gik her ikke til Havets Bred. Da vi vare komne paa Højden af Vestre Kors-Bugt, saa vi en stor Isbræ (Weyprechts Bræ), der skjød sig frem i Havet med en brat Ydervæg, og kort Tid efter viste sig en lignende, endnu større Isbræ (Kjerulfs Bræ). Den sidstes yderste bratte Væg var efter de anstillede Vinkelmaalinger 45 Meter høj. Bræerne kom frem under Taagen med en Overflade, der skraanede meget svagere end de stejle Bræer paa Østsiden. Jeg anslog Heldingen til c. 10°. Endnu en 3die Isbræ (Foyns Bræ) saaes østenfor den store. Den var mindre end de to andre. Da vi en af de følgende Dage atter passerede Nordsiden af Jan Mayen, laa Taagen højere, saa at vi bedre kunde se, hvorledes Nordsidens Bræer komme frem af dybe Indskjæringer i den 300^{m} høje, bratte Fjeldvæg, der her, ligesom paa Østsiden, danner Beerenbergs Fod ud mod Havet. Billedet Fig. 5 viser de 3 Bræer paa Nordsiden, saaledes som vi saa dem. Foran ligge opstablede Volde, Bræen selv er tagget og kløftet og belagt med Smuds og det Hele af-

were made of the coastal scenery. The various topographical and other data collected on this occasion, have been duly applied for the construction of the annexed Map.

On the west side of Mount Beerenberg, approximating the sea, lay a few patches of snow; but no glacier extended in this locality to the shore. Off West Cross Bay, we saw a large glacier (Weyprecht's glacier), jutting into the sea, with a steep outer wall; and shortly after another came in sight (Kjerulf's glacier), of still more imposing dimensions, its precipitous outer wall being found by trigonometrical measurement to attain an elevation of 150 feet. The glaciers here, as seen beneath the mist, had the slope of their surface much more gradual than the precipitous glaciers on the east side. I estimated the incline at about 10 degrees. A third glacier (Foyn's glacier) was sighted east of the large one. It was smaller than the other two. On one of the following days, as we again coursed along the northern shore of Jan Mayen, the clouds lay higher, affording a better view of the coast; and on this occasion the glaciers could be distinctly seen, projecting from deep clefts in the abrupt mountain-wall, which attains an altitude of 900 feet, and here, as on the east side, forms the seaward base of Mount Beerenberg. Fig. 5 gives a view of the 3

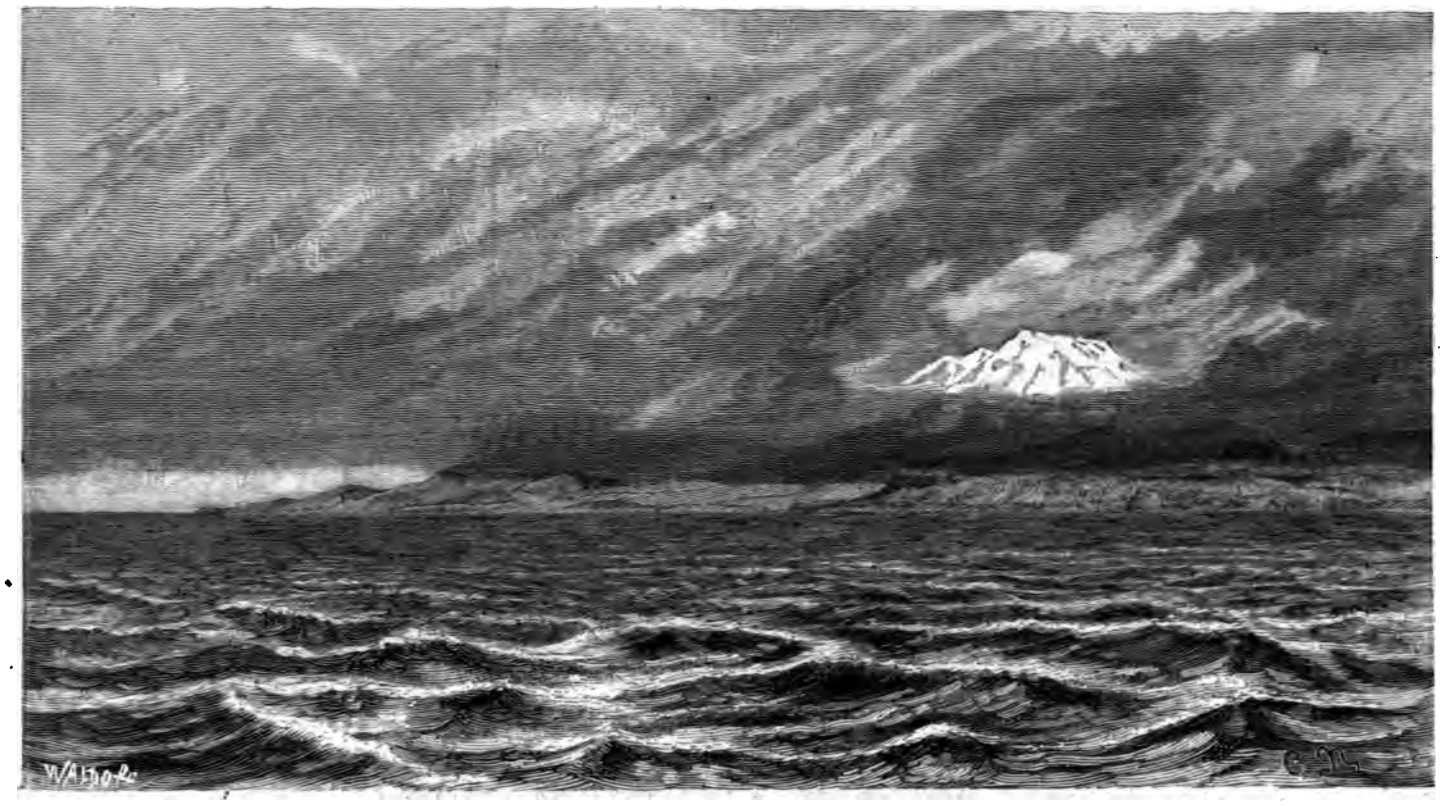


Fig. 4. Beerenberg fra Vest. — Mount Beerenberg, looking East.

giver et meget vildt Skue. Vi passerede i en Afstand af $2^1/_3$ Kvartmil.

glaciers on the north side as they appeared to us. In the foreground lie prodigious rampart-like masses of debris;

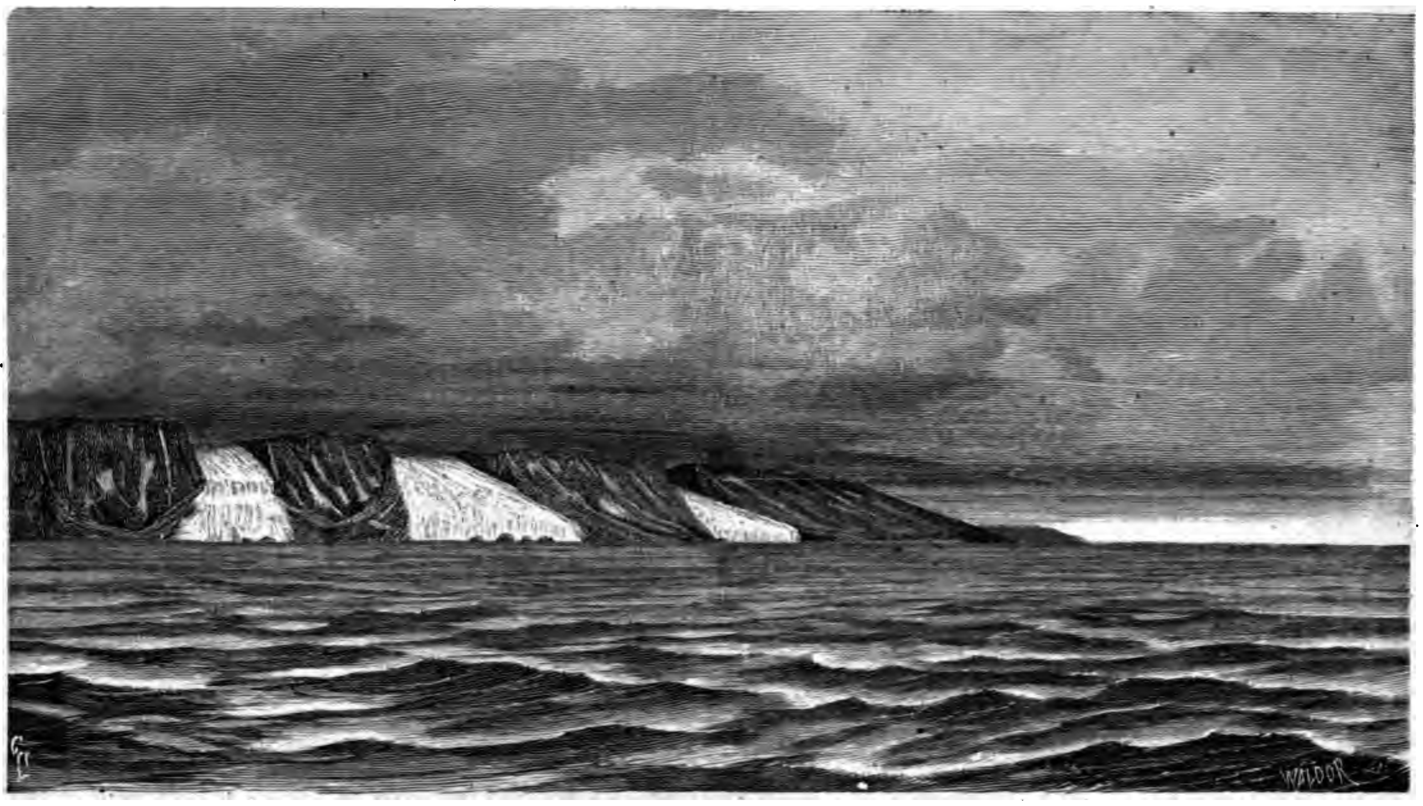


Fig. 5. Nordsidens Bræer. — The Glaciers of the North Coast.

Kl. 9 om Aftenen passerede vi Nordostkap. Vi kunde nu se Rækken af de stejle Bræer paa Østsiden. Der var ikke flere end 5 saadanne, som naaede Havfladen. Deres indbyrdes Beliggenhed bestemte jeg ved at notere de Øjeblikke efter Uret, da hver af dem observeredes tvers paa Kursen, der holdtes uforandret og med jevn Fart. Kl. 12,45 Min. om Morgenen ankrede vi i den store Rækved-Bugt paa 12 Favne Vand, udenfor Lagunen, i Vest for Ægøen.

Denne Dag, den 31te Juli, bleve vi liggende paa vor Ankerplads. Taagen fordelte sig noget, saa noget mere af Landet blev synligt; men Beerenberg var fremdeles tilhyllet. Derimod var Solen jevnlig fremme om Formiddagen og en Del af Eftermiddagen. Da Søgangen hindrede Landgang, toges Solhøjder fra Skibet.

Om Eftermiddagen forsøgtes Landgang med to Baade, men Brændingen var for svær til at man turde vove Forsøg paa at bringe Instrumenter i Land. Vi roede langs Lagun-

the glaciers, too, are jagged and riven, and discoloured with dirt; altogether it is a wild scene. We passed at the distance of two and one-third miles.

By 9 o'clock in the evening we had rounded Cape North-East; and now the series of precipitous glaciers on the east side of the island came in sight. Only 5 of these reached to the water's edge. Their relative position I determined by noting, watch in hand, the exact moment at which each was observed abreast of the vessel, keeping the same course and speed. At 12.45 a. m. we cast anchor in Great Wood Bay, in 12 fathoms, off the lagoon lying west of Egg Island.

The rest of the day, July 31st, we passed at our anchorage. The fog dispersing a little, more could be seen of the land; Mount Beerenberg, however, was still wrapped in clouds. Meanwhile, we had the sun out most of the fore part of the day, and at intervals in the afternoon. The swell being too heavy to admit of landing, a series of solar altitudes was taken from the ship.

In the afternoon two boats put off for the shore; but there was too much surf to risk landing the instruments. We rowed along the barrier of the lagoon to Egg Island,

Den følgende Dag, 1ste August, fik jeg om Formiddagen nogle Solhøjder fra Ankerpladsen. Vi lettede og stod sydover, loddede og skrabede paa 70 og 95 Favnes Dyb (se Kartet). Bunden var sort vulkansk Sand og Slik og Dyrelivet rigt; Vandet ved Bunden havde en Temperatur under 0°. Over Jan Mayens Sydland laa Taagen fremdeles og skjulte de øverste Dele, men over Nordlandet spredte Skyerne sig efterhaanden, saa at vi hele Eftermiddagen og Aftenen havde det herlige Syn af Beerenberg i fuld Solbelysning. Selvfølgelig vare alle Tegnere i fuld Virksomhed. Fra den nordligste af de paa Kartet med 95 Favnes Dyb betegnede Stationer tog jeg en Række Maalinger af Beerenberg: Horizontalvinkler og Højdevinkler med Sextant, Heldningsvinkler med det til mit geologiske Compas hørende Klinometer, samt flere Skitser. Dette Material er benyttet til Tegningen af mit Billede af Beerenberg.

Til Venstre ser man den sorte *Ægø* i lidt over 6 Kvartmils Afstand, det nærmeste Object. Havhorizonten ligger i lidt over 4 Kvartmils Afstand fra Øjet, og alle Strandpartierne dukke følgelig under denne. Til Højre for Ægøen sees Kraterne Esk og Vogt, begge med sine kløftede Kraterrender. Mellem Krater Vogt og det spidsere Fjeld (Scoresby's Berg) til venstre for samme, der ligger lige op for Østkanten af *Ægøen*, synes en Dal med en Bergmasse, der skraaner mod Vest og hvis Fod var synlig fra Ankerpladsen, maaske en Lavastrøm. Dens Farve var mere blaalig, medens Kraternes er rødlig. Østenfor Krater Vogt saaes, mindre tydelig, nogle Højder under Beerenbergs Fod, indtil man kommer til den store Sydbræ, der i en Bue gaar ned fra Snegrændsen til Havet. Partiet mellem Sydbræen og Sydostkap frembød i den betydelige Afstand, 9 til 12 Kvartmil, ikke mange Detaljer. Lige øst for Sydbræen kunde jeg se en Højde eller en Højderyg, der syntes at ende i et Fremspring i Havet, Scoresby's Cape Fishburn. Som man ser af Billedet, kunde Snegrændsens gjennemsnitlige Beliggenhed bestemmes med en ikke ringe Nøjagtighed. Dens Højde beregner jeg efter mine Maalinger til 706 Meter over Havet. Over Snegrændsen sees Beerenbergs Snekaabe, der dækker hele den øvre Del af Fjeldets Basis. Denne Basis er en flad Kegle; dens Skraaning maaltes paa Vestsiden til 8° og paa Østsiden, ned mod Sydostkap, til 10°.

Over Basiskeglen, der rækker op til en Højde af c. 1400 Meter, hæver sig Beerenbergs Askekegle med en ydre Skraaning af 42°. Denne fremtræder ren paa Vestsiden, medens der paa Østsiden skyder frem fra Keglen nogle Ribber, antagelig Lavagange gjennem Keglen, der reducere den apparente Skraaning til 32°. Paa Vestsiden maaltes, fra den 8° heldende Basis af, et længere Stykke med 15° Heldning, derpaa et kortere Stykke med 28°

On the following day, August the 1st, I took in the forenoon a few solar altitudes from the anchorage. We then got under weigh and stood south, sounding and dredging in 70 and 95 fathoms (see Map). The bottom consisted of black volcanic sand and ooze; and there was abundance of animal life. The bottom-temperature was below 0°. Over the southern part of Jan Mayen the fog still lay heavy, obscuring the most elevated tracts; but over the northern part the clouds were gradually dispersing, and throughout the afternoon and evening we had a magnificent sun-lit view of Beerenberg. All who could draw were now of course fully engaged in sketching the scenery. From the most northerly of the observing-stations at which the depth, as indicated in the Map, was 95 fathoms, I took a series of measurements of Mount Beerenberg, — horizontal and vertical angles, with the sextant, angles of inclination, with the clinometer belonging to my geological compass, and made besides several sketches. The material thus acquired has been carefully worked up for my prospect of Mount Beerenberg.

On the left-hand side, distant upwards of 6 miles, the black wall of Egg Island, the nearest object in the picture, is seen boldly projecting. The distance of the horizon being a little more than 4 miles from the point of view, all parts of the shore dip beneath it. To the right of Egg Island are seen the Esk and Vogt craters, with their jagged edges. Between Vogt's crater and the somewhat acuminate mountain to the left (Mount Scoresby) rising behind the eastern acclivity of Egg Island, extends a valley filled with a rocky mass, — possibly a current of lava, — the base of which was visible from the anchorage. This mass had a bluish tint, whereas the craters are of a reddish colour. East of Vogt's crater loomed a few summits at the foot of Mount Beerenberg, and farther on was seen the great southern glacier shelving down in a curve from the snow-limit to the sea. At so considerable a distance as 9 to 12 miles, the tract between the southern glacier and Cape South-East did not present many prominent details. East of the southern glacier, I could distinguish a summit or mountain-ridge terminating apparently in a headland, — Scoresby's Cape Fishburn. As will be seen from the plate, the snow-line could be determined with very considerable accuracy. Its elevation I computed from my measurements at 2316 feet above the sea. At that height commence the snows of Beerenberg, which cover the entire upper portion of the base of the mountain. The base has the form of an obtuse cone, that on the west side was found to incline 8°, on the east, towards Cape South-East, 10°.

Above the lower cone, which attains an altitude of nearly 4600 feet, towers the cone of ashes, with its outer slope shelving at an angle of 42°. On the west side the slope has the surface smooth, but on the east exhibits a few prominent ribs, probably dykes of lava, which reduce the apparent incline to 32°. On the west side, from where the base of the mountain shelves at an angle of 8°, the slope for a good way up was found to be 15°, then for a

Heldning, og endelig selve Keglens Heldning paa 42°. Paa Østsiden sees Underdelens Skraaning paa 10° at skyde sig foran de fjernere, i Skygge liggende Partier, der staa ud som Ribber fra den geometriske øvre Kegle. Solen stod, da Kraterets Konturer og Skygger skitseredes, i Vest, i Papirets Plan.

Den stejle Kratervæg er paa mange Steder snefri, og den sorte Aske viser her store Flekker af ofte bizarre Figurer. Kraterranden er tagget, men Sneen, der dækker den, giver Randen med dens Tagger ejendommelig bløde Omrids. Kraterranden er højest paa Vestsiden; der maaltes en gjennemsnitlig Heldning af den øverste Linie af $2^1/_2$ Grad. Det højeste Punkt af Beerenberg ligger saaledes (nu) paa Kraterets Vestside og, som Fig. 4 viser, noget mod Nord. Det er dette Punkt, hvis Højde vi have søgt at bestemme med et rundt Tal til 1950 Meter.

Fra Loddestationerne toge Officererne Pejlinger til Øens nordlige og sydlige Del. At bestemme Skibets paaværende Plads efter Pejlingerne og Scoresby's Kart, viste sig omtrent ugjørligt, da dette, i Overensstemmelse med de ældre hollandske Karter, giver Sydlandet for langt og for smalt.

Medens vi vare paa Søen, havde vi Anledning til at iagttage de voldsomme Hvirvelvinde, der kunne blæse under Beerenberg. For et Sejlskib maatte disse være yderst generende med de pludselige Omslag i Vindens Retning under sterke Byger. I disse maaltes en Vindhastighed af 15 Meter pr. Secund, den største Vindhastighed vi iagttog under 1877 Aars Rejse. Fra Søen saa vi, hvorledes det fine Tufsand fra Ægøen reves løs og førtes højt op i Luften som en mørk Røgsky med de sterke Vindbyger. Med den vulkanske Ø for Øjne skulde der ikke nogen sterk Indbildningskraft til, for at man kunde tro at se Ildsluer bryde ud fra Ægøen og saaledes komme til at medbringe Efterretning om at have været tilstede ved et vulkansk Udbrud. Heldigvis havde vi Dagen før havt Anledning til at overbevise os om Sagens sande Natur. Om Aftenen ankrede vi i den store Rækvedbugt et Par Kvartmil i Sydvest for den forrige Ankerplads.

Næste Morgen, den 2den August, var Beerenberg fremdeles synlig. Vi lettede og stod østover, passerede Ægøen og loddede i 195 Favne udenfor Sydbræen. Paa Veien saa jeg tydelig inde paa Underlandet under Krater Vogt det af Carl Vogt i 1860 observerede og beskrevne lave Krater Berna. Fremdeles saa jeg, at Sydbræen gik lige til Stranden, men at dens nederste Del var bedækket med Smuds. Efter Lodningen gjorde vi et Forsøg til Bestemmelse af Højden af Beerenberg. Efter et godt Med (Ægøens Kant over et markeret Punkt inde paa Land) sejledes i en nøjagtig udmaalt Tid, medens Skibets Fart hvert 5te Minut observeredes efter Loggemaskinen. Ved Begyndelsen og Enden af dette Tidsrum maalte med Sex-

short distance 28°, the incline of the upper cone itself reaching, as previously stated, 42°. On the east side, the slope of the lower cone, that shelves at an angle of 10°, was seen extending before the more remote parts of the upper declivity, which lay in shadow, and like huge ribs project from the upper cone. When sketching the contours and shadows of the crater, I had the sun in the same plane as the paper.

The precipitous walls of the crater being in many places bare of snow, large patches of the black surface make their appearance, many of them grotesque in form. The ridge of the crater is extremely rugged; but the snow covering the jagged edges imparts a wonderful softness of outline. The ridge of the crater is highest on the west side; and its average incline was found to be $2^1/_2$ degrees. The most elevated point of Mount Beerenberg is accordingly (now) on the west side of the crater, and, as shown in Fig. 4, lies a little towards the north. It is this point the altitude of which we have approximately determined at 6400 feet.

From the sounding-stations, the ship's officers took bearings of points in the northern and southern parts of the island. To determine the ship's position from bearings and Scoresby's map proved well-nigh impossible, since the latter, based as it is on the earlier Dutch maps, gives the southern part of the island at once too long and too narrow.

Whilst engaged in sounding, we had opportunity of observing the violent whirlwinds that are often encountered on passing east of Beerenberg. To sailing-vessels they must prove a serious annoyance, owing to the sudden changes in the direction of the wind during heavy squalls. On one such occasion the velocity of the wind was found to reach 15 metres a second, the greatest velocity observed on the cruise in 1877. In the strong eddying gusts the fine tuff-sand of Egg Island would be caught and whirled aloft like a dense cloud of dust or ashes. With the volcanic island in immediate proximity, it required no great stretch of the imagination to fancy you saw flames bursting forth from the crater, and thus bring away the erroneous impression of having witnessed a volcanic eruption. Fortunately, we had had on the previous day opportunity of ascertaining the true nature of the phenomenon. In the evening we cast anchor in Great Wood Bay, a couple of miles south-west of our former anchorage.

Next morning, August the 2nd, Mount Beerenberg was still visible. We got under weigh, steering east, past Egg Island, and sounded in 195 fathoms, off the southern glacier. As we steamed along the coast, I could plainly distinguish on the low-lying tract beneath Vogt's crater the low Berna crater, observed and described by Carl Vogt in 1860. Moreover, I could follow the direction of the southern glacier to where it reaches the sea: its lower extremity was covered with dirt. After sounding, an attempt was made to determine the altitude of Mount Beerenberg. Selecting a good bearing (the base of the outer wall of Egg Island in a line with a salient inland point) we steamed ahead in this direction for a given time, accurately measured, the

tant, paa givet Signal, en Iagttager Vinkelen mellem Medet og Toppen, og en anden Iagttager Toppens Højde over Horizonten. Resultatet af Beregningen var 1945 Meter.

Om Eftermiddagen loddedes 340 Favne udenfor Sydostkap. Kursen sattes nu nordover. Taagen begyndte at omhylle Beerenberg og vi saa dens Top og Skuldre for sidste Gang. I Nordost for Nordostkap. 7 Kvartmil af, fandtes en Dybde af 1040 Favne. Dette giver en midlere Heldning af Havbunden udenfor Nordostkap af 8 Grader, hvilket er noget brattere end Heldningen af Beerenbergs Basis henimod Nordostkap (efter Kartet 6.°6), men mindre brat end Heldningen mod Sydostkap (10°). Paa Skraaningen ned mod Nordostkap saaes en Eruptionskegle (Krater Sars), som findes i ældre Tegninger. naar man ser nøje efter. saaledes i Vogt's Rejse og paa Lieutenant Ring's Tegning Fig. 7. Paa Nordsiden af Øen saaes de 3 Isbræer trædende frem af dybe Dale foran den bratte, 60° heldende, 300 Meter høje Fjeldvæg, Fig. 5. Hvad der laa højere, var dækket af Skylaget. Vi fik saaledes desværre ikke se Beerenberg og dens Grundstykke fra Nordsiden, og de store Bræers Udspring fra Snegrændsen gik ligeledes vor Iagttagelse forbi, da Taagen efterhaanden sænkede sig.

Efter at have taget en Række Lodskud i Nord og Nordvest for Jan Mayen, og fundet over 1000 Favnes Dyb paa vort vestligste Punkt. hvor Luftens Temperatur om Natten var kun lidt over Frysepunktet. men ingen Is var at se, styredes tilbage mod Øens Vestside. Da vi om Formiddagen den 3die August nærmede os Mary Muss Bugten, var Vejret fremdeles meget taaget. Vi styrede videre langs Landet sydvestover og spejdede opmerksomt efter en Lejlighed til at komme i Land paa Sydlandet, men forgjæves. Ofte tog Taagen Udsigten til Land ganske bort, og overalt saa vi Brændingen paa Stranden lige sterk som da vi forgjæves prøvede at lande paa Østsiden. Vi stoppede paa et Par Stationer og loddede — se Kartet — 98 og 156 Favne. Fra disse Stationer og fra flere andre Punkter fik vi gode Skitser af enkelte Partier af de lavere Dele af Sydlandet. Efter disse er saaledes Fig. 6 gjengivet. Man ser den regelmæssige Eruptionskegle Hoyberg ude mod Stranden. Længere inde, ved Guinea Bugten. dukker et lidet, men meget regelmæssigt kegleformigt Krater (Høsaaten) op af Lavlandet. Den lave Sydpynt vender lige mod Tilskueren. Bagenfor det foranliggende Lavland løfter sig med bratte Vægge Sydlandets Højfjeld. Oppe paa dette sees et kegleformet Fjeld (Krater Vøringen), et Krater efter al Sandsynlighed. De bratte Styrtninger mod Havet fortsætte lige til Cap Sydvest. Her er en naturlig Port i Fjeldet, gjennem hvilken Havet gaar. Udenfor Nesset sees de Syv Klipper med sine fantastiske Former.

speed of the ship being read off every five minutes on the scale of the water-log. At the beginning and the end of this interval, at a given signal, one observer measured with the sextant the angle subtending between the bearing and the summit of the mountain, and another the height of the summit above the horizon. The result of the computation was 6380 feet.

In the afternoon we sounded in 340 fathoms off Cape South-East, and then steered northward. Clouds had now begun to gather round Beerenberg, and we had our last view of the summit and upper part of the mountain. North-east of Cape North-East, 7 miles from land, the depth was 1040 fathoms. This shows a mean incline of the sea-bed off Cape North-East of 8 degrees, which slightly exceeds that of the base of Mount Beerenberg towards Cape North-East (according to the Map 6.°6), but is somewhat less than the slope towards Cape South-East (10°). On the north-eastern declivity was seen a parasitic cone (Sars's crater), which may be found in earlier views of the island if carefully looked for, for instance in a prospect in Vogt's Travels, and in one by Lieutenant Ring, Fig. 7. On the north side of the island the 3 glaciers could be seen jutting out from deep valleys beyond the precipitous mountain-wall, which is here 900 feet high and shelves at an angle of 60°, Fig. 5. Whatever lay at a greater elevation was wrapped in clouds. Unfortunately, therefore, we got no view of Mount Beerenberg from the north side of the island, and the origin of the glaciers at the snow-limit likewise escaped our observation, the fog having gradually descended.

After having taken a series of soundings to the north and north-west of Jan Mayen, and found a depth of more than a thousand fathoms at the most westerly station, where the temperature of the atmosphere at night was only a little above the freezing-point, though no ice was to be seen, we steamed back to the west side of the island. In the forenoon of August the 3rd, when bearing down on Mary Muss Bay, the weather was exceedingly foggy. We steered thence in a south-westerly direction along the coast, carefully watching for an opportunity to land, — but in vain. The fog frequently shut out the land; and a line of breakers was everywhere observed along the shore, the swell being no less heavy than on the occasion of our unsuccessfull attempt to land on the east side of the island. We stopped twice and sounded (see Map) in 98 and 156 fathoms. At these stations and several other points we succeeded in sketching the scenery of the low-lying tract in the southern part of Jan Mayen. Fig. 6 is from these sketches. Near the shore we see the parasitic crater Hoyberg; and farther inland, in the vicinity of Guinea Bay, a conical crater, — the "hay-cock," — small but regular in form, rises from the low-lying tract around it. The Low South Point projects in a line with the point of view. Behind the low tract in the foreground of the engraving, towers with its precipitous walls the plateau of the southern part of Jan Mayen. Here may be seen a conical-shaped mount (the Vøringen crater), in all probability of

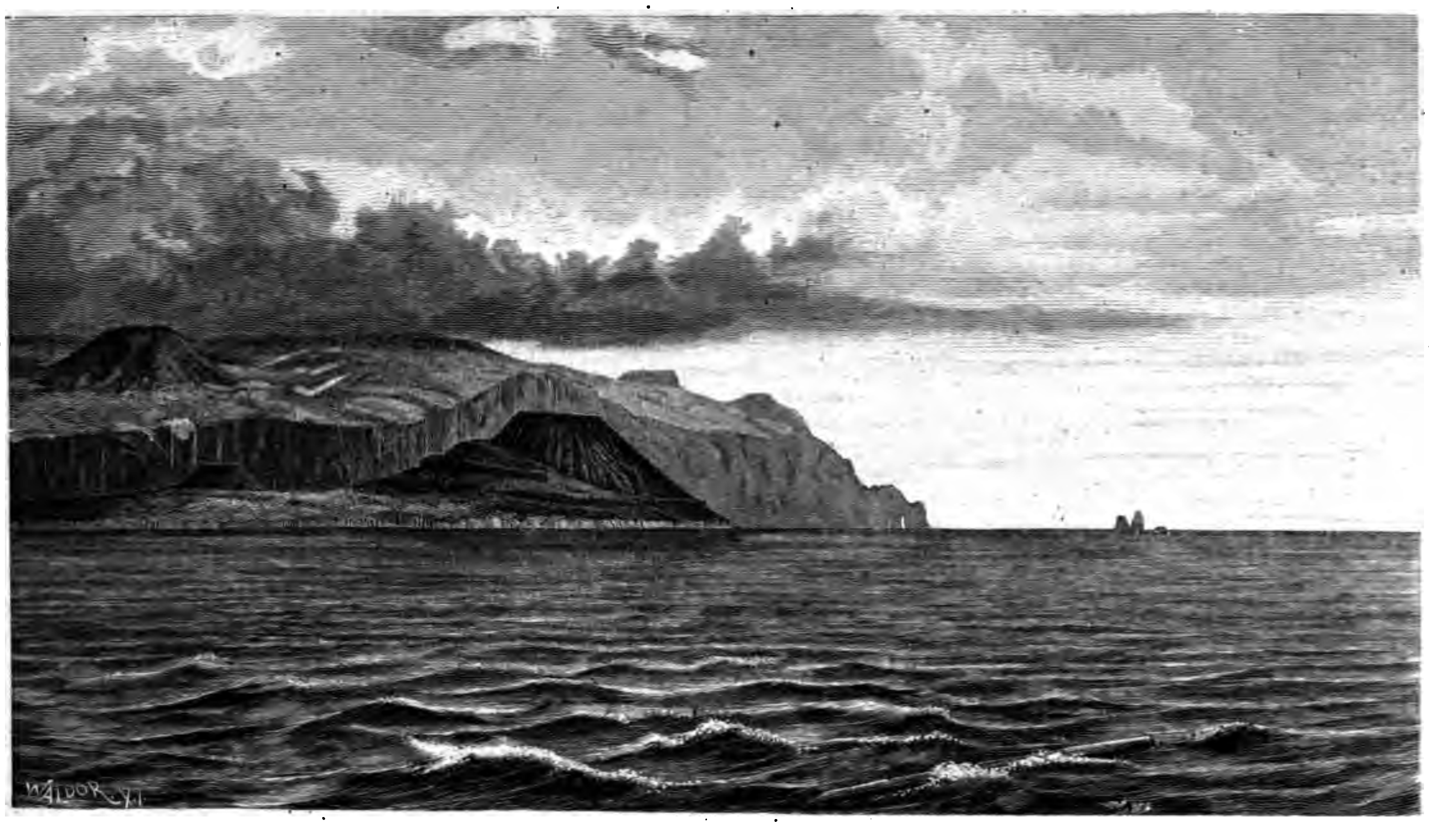


Fig. 6. Hoyberg.

Det var det sidste, vi saa af Jan Mayen. Taagen indhyllede atter alt. Vi fik Intet at se af Sydkysten eller Sydostkysten, idet vi styrede videre sydvestover.

Billedet, Fig. 7, der viser Jan Mayen i Vinterdragt, seet fra Nordvest, skyldes en Tegning af Lieutenant i den norske Marine S. Ring, der som Fører af Sælfangeren "Capella" har havt Anledning til at se Jan Mayen klar fra denne Kant. Man ser paa Skraaningen ned mod Nordostkap Krater Sars, man øjner de store Isbræer paa Nordsiden, Cap Nordvest og Muyens Korsnes vende mod Tilskueren, den lave Del af Øen paa Midten og Sydlandets Højder træde klart frem. Beerenbergs Krater viser sig med indsunket Rand paa Nordsiden, og derunder en vid Dal eller Kjedel, hvorfra de store Nordbræer tage sit Udspring.

eruptive origin. The precipitous declivities facing the sea extend to Cape South-West. Here there is a "gate," or natural excavation, in the mountain-wall, through which the sea passes. Off the promontory rise the Seven Rocks, with their rugged, fantastic contours.

This was the last we saw of Jan Mayen. The fog had again begun to thicken, and soon shrouded everything from view. Nothing could be seen of either the south or the south-east coast as we steamed ahead on a south-westerly course.

For the prospect (Fig. 7) of Jan Mayen in its winter garb, as seen from the north-west, we are indebted to a drawing from the pencil of Lieutenant S. Ring, R. N., who, when commanding the sealer "Capella," sketched this part of the island on a clear day. We have Sars's crater, on the slope shelving towards Cape North-East; we see, too, the great glaciers on the north side, also Cape North-West and Muyen's Cross Cape, in a line with the point of view; and the low tract of the island, with the heights of the southern part, are boldly defined in the picture. The crater of Beerenberg, with its sunken edge on the north side, is also seen, and lower down a huge, cauldron-shaped depression, from which the great northern glaciers take their origin.

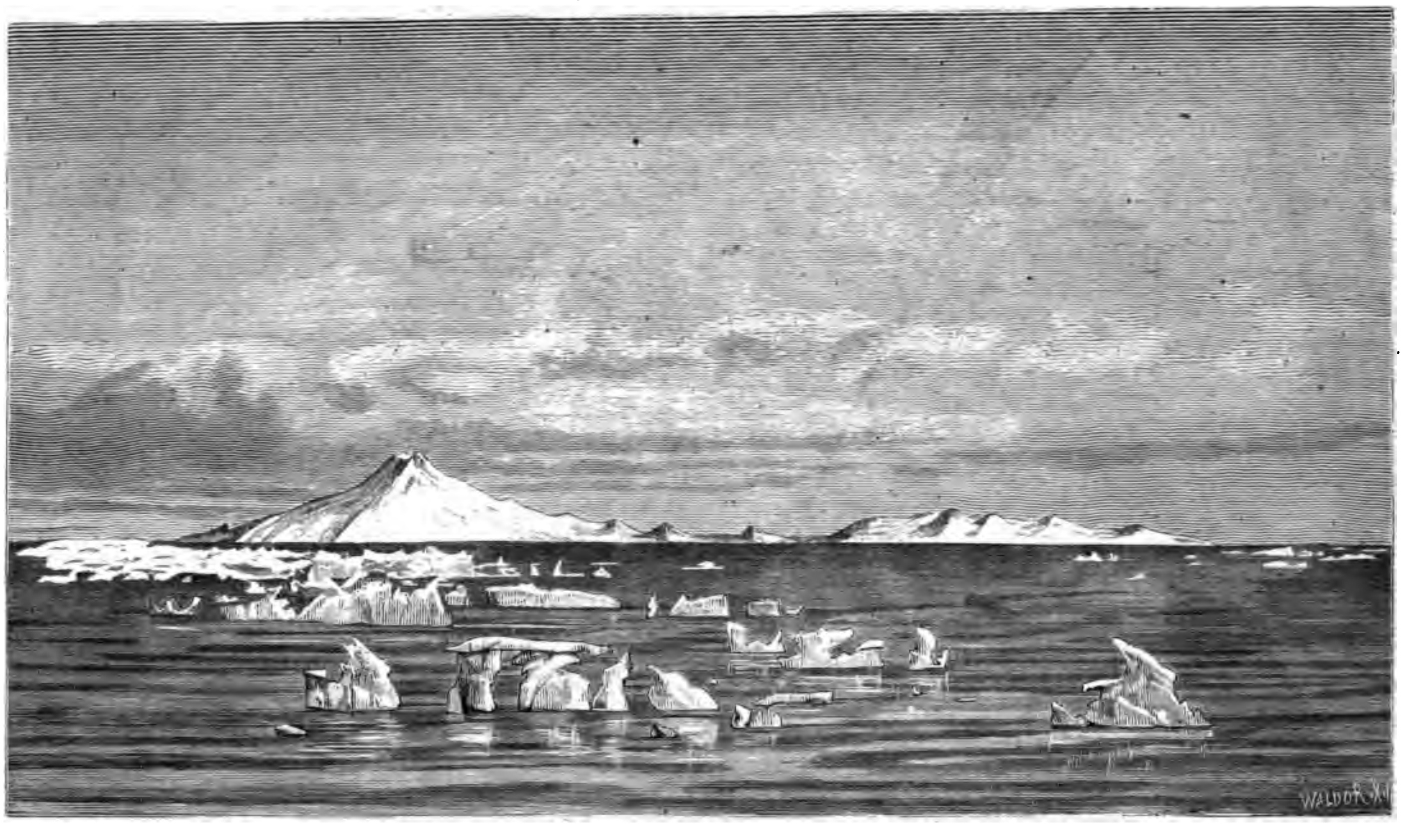


Fig. 7. Jan Mayen i Vinterdragt, fra Nordvest. — Winter View of Jan Mayen, looking South-East.

Af den foranstaaende Rejsebeskrivelse vil man se, hvorledes vor Expedition samlede det Materiale, vi have benyttet til at forbedre Kartet over Jan Mayen. Da Expeditionens Hovedformaal var at undersøge Havet, kunde vi anvende kun en kortere Tid til Undersøgelsen af Jan Mayen, og de Iagttagelser, som vi hertil kunde samle, maatte blive udførte lejlighedsvis, eftersom Omstændighederne tillod det. Vi kunde saaledes ikke afvente de gunstigere Omstændigheder, der vare nødvendige for en mere gjennemført Undersøgelse, men vare nødte til at combinere de erholdte Observationer og deres Resultater paa bedste Maade indbyrdes og med ældre Undersøgelsers Resultater. Dette har kostet ikke lidet Arbejde, og det af Captein Wille og mig udarbejdede Kart er Frugten af en Række gjentagne Forsøg paa at tilfredsstille alle de spredte Iagttagelser, der foreligge. Som man vil se, vare vi under vort Ophold ved Jan Mayen ikke særdeles begunstigede af Vejret, men vi vare heller ikke særdeles uheldige, — dog var der liden eller ingen Lejlighed til at anstille *systematiske* Iagttagelser.

Af ældre Literatur vedrørende Jan Mayen er til Kartet og Beskrivelsen benyttet følgende:

1. De Nieuwe Groote Zee-spiegel, inhoudende Eene Beschryvinghe der Zee-Kusten van de oostersche en noordsche Schip-vaert. Amsterdam 1662. Beskrivelsen af Jan

The foregoing account of our exploratory work will show in what manner data were collected on the Norwegian Expedition for constructing a new map of Jan Mayen. The main object of the Expedition being to investigate the physical conditions of the sea, the time we could devote to the exploration of Jan Mayen was of course comparatively short; and the observations we succeeded in obtaining had to be taken occasionally, according as opportunity offered. Thus it was not in our power to carry out a complete investigation; we could only combine in the best possible manner our observations and their results, collating them with those of earlier explorers. To do this has cost considerable labour, and the Map constructed by Captain Wille and myself is based on a series of re-iterated attempts to combine all the scattered data before us. As previously shown, the weather during our stay at Jan Mayen was neither particularly favourable nor exceptionally bad; but we had little or no opportunity of instituting *systematic* observations.

Of earlier works on Jan Mayen, the following have been consulted: —

1. — De Nieuwe Groote Zee-spiegel, inhoudende Eene Beschryvinghe der Zee-Kusten van de oostersche en noordsche Schip-vaert. Amsterdam 1662. To this account is

Mayen ledsages af et "Pas-caert van Jan Mayen Eylant". I den benyttede Udgave mangler desværre et Blad, paa hvilket Beskrivelsen af Øens Nordside skulde være at finde. En noget forkortet Oversættelse af denne Beskrivelse til Tysk, som Professor Buijs Ballot i Utrecht har havt den Godhed at sende mig, slutter imidlertid med den Bemerkning, at Beskrivelsen af Nordsiden mangler. Forøvrigt beskrives i dette gamle Verk Østkysten helt fra Nordostkap sydover og Vestkysten fra Sydkap nordover indtil Nordvestkap. Kartet, der aabenbart er det som ligger til Grund for alle de senere Karter over Jan Mayen, forekommer mig i sine Hovedtræk at være lige saa godt som disse.

2. C. G. Zorgdragers alte und neue Grönlandische Fischerei und Wallfischfang, . . . ausgefertiget durch Abraham Moubach. Leipzig 1723. For Jan Mayens Vedkommende har jeg i dette Verk ikke fundet noget mere end i det foregaaende, der aabenbart er Kilden.

3. An Account of the Arctic Regions, . . . by W. Scoresby Jun. F. R. S. E. Edinburgh 1820. Til Grund for Scoresby's Kart ligger Zorgdragers, der aabenbart igjen har til Kilde det gamle Kart i "Zee-spiegel". Hele Øens Beliggenhed er rectificeret af Scoresby, men i Detaljerne er det gamle Kart fremdeles det paalideligste.

4. Letters from High Latitudes, being some account of a voyage, in 1856, in the schooner-yacht "Foam," to Iceland, Jan Mayen, & Spitzbergen. By Lord Dufferin. Fourth Edition. London 1858.

5. Nord-Fahrt, entlang der Norwegischen Küste, nach dem Nordkap, den Inseln Jan Mayen und Island, . . . unternommen während der Monate Mai bis Oktober 1861 von Dr. Georg Berna, . . . Erzählt von Carl Vogt. Frankfurt a. M. 1863.

Det Kart, som ledsager Vogt's Beskrivelse, er en Copi af Scoresby's Kart. Det indeholder en Del Forbedringer, men er paa den anden Side, navnlig i hydrografisk Henseende, mindre fuldstændigt og correct end de ældre Karter. Derimod have de Billeder af Partier af Jan Mayen, der ledsage Vogt's Verk, været mig af overordentlig stor Nytte, og for deres store Paalidelighed kan jeg indestaa. Endog mindre Træk i Landskabet har jeg efter disse Billeder kunnet identificere.

Til Grund for Constructionen af vort Kart er lagt Scoresby's. Efter de af os foretagne Pejlinger og andre Vinkelmaalinger har Capt. Wille gjort et Udkast til Kystens Form, og anbragt derved de hydrografiske Detaljer fra vore Iagttagelser, saa langt de rak, og fra Scoresby. Efter det Material, som stod til min Raadighed, heri indbefattet en Række Skitser af Hr. Schiertz, vor Tegner, Professor Sars og mig selv, har jeg forsøgt at aflægge yderlige hydrografiske Detaljer, dels efter "Zeespiegel", idet jeg fandt, at Beskrivelsen og Kartet i dette var rigtigere end i de senere Verker, dels ved Hjelp af Skitserne, efter hvilke jeg kunde bestemme noget sikrere enkelte Partiers indbyrdes Beliggenhed, navnlig i Forbindelse med de verticale Dimensioner. Situationen

annexed a "Pas-caert van Jan Mayen Eylant." In the edition I have consulted, the leaf on which an account of the north coast of the island might have been looked for, is unfortunately missing. A somewhat abridged translation of this work into German, which Professor Buijs Ballot of Utrecht had the kindness to send me, closes, however, with the remark, that no account has been given of the north side. For the rest, in this old volume the east coast is described from Cape North-East southwards, and the west coast, from Cape South northwards to Cape North-West. The map, which is manifestly that on which all later maps of Jan Mayen are based, would appear in its main features to be quite as correct as any of these.

2. — C. G. Zorgdragers alte und neue Grönlandische Fischerei und Wallfischfang, . . . ausgefertiget durch Abraham Moubach. Leipzig 1723. As regards Jan Mayen, I found nothing in this work that is not contained in the foregoing, whence the author has evidently drawn his information.

3. — An Account of the Arctic Regions . . . by W. Scoresby Jun. F. R. S. E. Edinburgh 1820. Scoresby's map is based on Zorgdrager's, which in turn is evidently derived from the old map in the "Zee-spiegel." The position of the island has, indeed, been rectified by Scoresby; but in all details the old map is still the most trustworthy.

4. — Letters from High Latitudes, being some account of a voyage, in 1856, in the schooner-yacht "Foam," to Iceland, Jan Mayen, & Spitzbergen. By Lord Dufferin. Fourth Edition. London 1858.

5. — Nord-Fahrt, entlang der Norwegischen Küste, nach dem Nordcap, den Inseln Jan Mayen und Island, . . . unternommen während der Monate Mai bis Oktober 1861 von Dr. Georg Berna, . . . Erzählt von Carl Vogt. Frankfurt a. M. 1863.

The map annexed to Vogt's account of the Island is a copy of Scoresby's. It is, indeed, in some respects more correct, but in others, more particularly as regards the hydrographical details, less complete and trustworthy than the earlier maps. On the other hand, the views of the Island accompanying Vogt's work have rendered me the greatest service; and for their accuracy, which is remarkable, I can personally vouch. Even minor features of the scenery, I have been able to identify from these excellent illustrations.

Our map of Jan Mayen is based on Scoresby's. From the various bearings and other measured angles, Captain Wille has figured the contours of the coast, and set down, so far as possible, the hydrographical details, from our own observations and those of Scoresby. After a careful study of the material collected, including numerous sketches by Mr. Schiertz, artist to the Expedition, Professor Sars, and myself, I have sought to fill in further hydrographical details, partly since I find the account and map in the "Zeespiegel" to be more correct than are any of those given in later works on Jan Mayen, and partly with a view to determine, by means of the sketches, with greater accuracy the relative position of divers parts of

paa Kartet, der er fremstillet ved Højdekurver for hver 100 Meter, beror paa vort fælles Arbejde, saaledes at de store Træk ere udkastede af Capt. Wille, medens jeg har nærmere udarbejdet Detaljen. Herved er stadig taget Hensyn til, at Skitserne gjerne, som ogsaa de udførte Vinkelmaalinger vise, overdrive de verticale i Forhold til de horizontale Dimensioner. Efter mange gjentagne Forsøg er det i det Hele taget lykkets mig at tilvejebringe en god Overensstemmelse mellem Skitserne og de tagne Vinkelmaal.

Øens geografiske Beliggenhed er aflagt efter vore astronomiske og geodetiske Observationer.[1]

Ved Sammenligning mellem de ældre Karter og vort vil man finde adskillige Afvigelser. Jeg skal her vise de vigtigste af disse.

Scoresby's Bredder stemme gjennemgaaende godt med vore. Efter Udmaaling af 19 Punkter finder jeg, at Scoresbys Bredder i Gjennemsnit er et halvt Minut større end vore, og den største Forskjel er 2 Minuter. Scoresby's Længder ere derimod gjennemsnitlig 28 Bueminuter mindre end vore. Afvigelserne variere mellem 20 og 33 Minuter. Med andre Ord, Jan Mayen ligger efter vor Bestemmelse lidt over 9 Kvartmil længere Vest end i Scoresby's Kart og i de hidtil brugte Søkarter. Da vor Længdebestemmelse ikke er usikker paa mere end nogle faa Tidssekunder, bliver Jan Mayens geografiske Beliggenhed at rette i Karterne. Ogsaa den hollandske Expedition med Skonnerten "Willem Barendsz" i 1878 fandt Jan Mayens vestlige Længde større end Karterne angive. Scoresby's Bestemmelse er fra August 1817; han havde da været i Søen fra Vaaren af, og det er ikke at undres over, at hans Chronometers beregnede Stand kunde afvige betydeligt fra den rigtige.

"Zeespiegel" lægger Jan Mayen mellem Bredderne 71° 0′ og 71° 30′, altsaa en 15 Minuter for langt mod Nord, og Øens Midte paa Meridianen af Cap Landsend, eller 5° 40′ Vest for Greenwich, det er næsten 3 Grader for langt mod Øst.

Den nordlige Del af Øen og den midterste lave Del stemme i sine større Omrids vel overens paa alle Karter. Den sydlige Del derimod have vi fundet kortere og bredere end paa de ældre Karter, et Resultat, der fremgaar saavel af vore Vinkelmaalinger som af de, med Loggemaskinen bestemte, udsejlede Distancer.

Efter alle vore Vinkelmaalinger, saavel horizontale som verticale, og efter alle Skitser ligger Beerenbergs Kegle og Krater mere centralt paa Nordlandet end hos Scoresby og Vogt. Vi fandt Højden af Beerenberg den 3die August at være 1945 Meter, medens Scoresby angiver den til 6870

[1] Se H. Mohn. Astronomiske Observationer Side 23.

the island, in particular as regards their vertical extent. The relief of the land — shown on the Map by contour lines for every 100 metres, — is the result of our joint labours, Capt. Wille having laid down the general features while I worked out the details. Regard has been everywhere had to the tendency exhibited in the sketches, as confirmed too by the trigonometrical measurements, of increasing the vertical and lessening the horizontal extent. After numerous re-iterated attempts I at length succeeded in attaining satisfactory agreement between the sketches and the trigonometrical measurements.

The geographical position of the island is that found from our astronomical and geodetical observations.[1]

On comparing the earlier maps of Jan Mayen with that we have now constructed, ours will be found to differ in many respects. I will point out the most important.

Scoresby's latitudes agree on the whole satisfactorily with those determined by ourselves. By direct measurement of 19 points, I found Scoresby's latitudes on an average to exceed ours by half a minute; the greatest difference is 2 minutes. Scoresby's longitudes, however, are on an average 28 minutes of arc less than ours. The difference varies between 20 and 33 minutes. In short, Jan Mayen, according to our determination, lies a little more than 9 miles farther west than it does on Scoresby's map and the charts in use up to the present time. As the error of our determination of longitude does not amount to more than a few seconds in time, the geographical position of Jan Mayen on maps and charts will henceforth have to be rectified. The Dutch Expedition, too, despatched in 1878 with the schooner "Willem Barendsz," found the west longitude of Jan Mayen to be greater than that given in the charts. Scoresby's determination dates from August 1817. As captain of a whaler, Scoresby had then been at sea since the spring of the year; and hence it is not surprising that the true error of his chronometer should have deviated considerably from that computed.

The "Zeespiegel" places Jan Mayen between the parallels 71° 0′ and 71° 30′, thus 15 minutes too far north, and the middle of the island on the meridian of Land's End, or 5° 40′ west of Greenwich — nearly 3 degrees too far east.

The northern part of the island and the low-lying central tract agree well in their general contours on all the maps. The southern part, on the other hand, we found to be shorter and broader than it is given on the earlier maps, a result derived alike from our trigonometrical observations and the extent of the coast as determined by the water-log.

According to all our trigonometrical measurements, both horizontal and vertical, as also the numerous sketches, the cone and crater of Mount Beerenberg should have a more central position in the northern part of the island than has been given them by Scoresby and Vogt. We found

[1] H. Mohn. Astronomical Observations, p. 23.

engelske Fod eller 2094 Meter. De Højdemaalinger, som jeg fik fra Ankerpladsen i Mary Muss Bugten og fra Loddestationen No. 224 paa Østsiden (Side 12) stemme meget vel med en Højde af 1945 Meter, idet de give, Distantserne tagne efter Kartet, respective 1968 og 1944 Meter.

Paa alle de ældre Karter findes paa Vestsiden af Beerenberg, ved Havet, mellem første og andet Korsnes, et Sted betegnet som en Isbræ. Det hedder i "Zeespiegel": *Heynste Ysbergh*, hos Scoresby: *Iceberg*, og hos Vogt er vist en fra Beerenbergs Side til Havet udgaaende stor Isbræ. Da vi besøgte Jan Mayen, fandtes her paa denne Kant ingen Isbræ, der gaar til Havet. Vi saa kun enkelte Sneflækker paa den lavere Del af Øen. Scoresby og Vogt, der begge kun saa Jan Mayens Østkyst, have aabenbart hentet denne Bræ fra det gamle hollandske Kart. Er Bræen forsvunden siden Begyndelsen af det 18de Aarhundrede? Zorgdrager har den, og den staar nævnt i Beskrivelsen i "Zeespiegel". Eller foreligger en Forvexling med Bræerne paa Nordsiden?

De 3 store Isbræer paa Nordsiden af Jan Mayen findes ikke angivne paa Kartet i "Zeespiegel", og heller ikke hos Zorgdrager, Scoresby eller Vogt. Nordsiden er, som tidligere nævnt, ikke beskrevet i "Zeespiegel", men paa Zorgdragers Kart findes angivet Trankogerier i østre Korsbugt, saa at man maa antage, at denne Kyst i tidligere Tider var vel kjendt. Have disse Bræer først siden Midten af forrige Aarhundrede naaet den nuværende Udstrækning?

Paa Østsiden af Beerenberg saa vi fem store Isbræer, der med en brat Heldning gik lige ned til Havet. Flere end dette Antal kunde med Bestemthed ikke anføres. "Zeespiegel" har saavel i Kartet som i Beskrivelsen kun 3 Isbræer her, i Beliggenhed svarende til de tre nordligste, ligesaa Zorgdragers og Scoresby's Kart, hvilket sidste dog grupperer dem noget anderledes, idet de to sydligste ere lagte paa noget nær samme Plads, som vore to sydligste. Scoresby's Billede derimod viser flere end 5 til Havet nedrækkende Bræer paa denne Kyst, hvilke det er vanskeligt at identificere med de af os sete. Paa Kartet i Berna's "Nordfahrt" kan jeg ikke gjenfinde vore fem Bræer, men vel paa Billedet af Østkysten i samme Verk. Ere de stejle Isbræer paa Østkysten med Hensyn til Antal og Betydenhed vexlende med Tiderne?

Sydbræen findes ikke paa Karterne i "Zeespiegel", hos Zorgdrager og Scoresby, omtales heller ikke i disses Beskrivelser. Den forekommer først hos Vogt, hvis Kart, Billeder og Beskrivelse stemme godt med vore Iagttagelser. Kysten udenfor er, efter de ældre Beskrivelser, meget uren, saa at Bræen maaske ikke havde nogen hydrografisk Inter-

the altitude of Beerenberg — August the 3rd — to be 6380 feet, whereas Scoresby's determination is 6870 feet. The altitudes I succeeded in taking from our anchorage in Mary Muss Bay and from Sounding-station 224, on the east side of the island (page 12), agree very well with a height of 6380 feet, corresponding as they do to 6457 and 6377 feet.

On the west side of Beerenberg, in close proximity to the sea, between the first and second Cross Capes, there is in all of the earlier maps a point marked to denote a glacier. In the "Zeespiegel" it bears the name of *Heynste Ysbergh;* Scoresby calls it *Iceberg;* and in the map accompanying Vogt's work on Jan Mayen a large glacier is here seen extending down the slope of the mountain to the sea. When *we* visited the island, there was no glacier reaching out to the sea on this side. We merely saw a few patches of snow scattered here and there over the lower tract of the coast. Scoresby and Vogt, both of whom saw only the eastern shores of Jan Mayen, have manifestly followed the old Dutch map. Can the glacier have disappeared since the beginning of the 18th century? Zorgdrager has it, and it is mentioned in the account given in the "Zeespiegel." Or has there been some mistake connected with the glaciers of the north side?

The 3 great glaciers on the north coast of Jan Mayen are not to be found on the map in the "Zeespiegel," nor on those by Zorgdrager, Scoresby, or Vogt. As previously mentioned, no account is given of the north side in the old Dutch work; but on Zorgdrager's map we have given the position of factories established in East Cross Bay for boiling down blubber; and hence that coast must have been well known in former times. Possibly, the glaciers in question did not attain their present extent till the middle of the last century.

On the east side of Beerenberg, we saw 5 large glaciers shelving abruptly down to the sea. A greater number could not be clearly distinguished. Only 3 glaciers are to be found here on the map in the "Zeespiegel," corresponding in position to the three northernmost of ours, as also on the maps by Zorgdrager and Scoresby, though the latter groups them somewhat differently, the two lying farthest south having almost the same position as the two most southerly of those observed by ourselves; but on the other hand, in Scoresby's view of the coast more than 5 glaciers, which can hardly be identified with those we observed, extend down to the sea. On the map in Berna's "Nordfahrt" I cannot find our 5 glaciers; in his view of the east coast, however, in the same work, they are easy to identify. Do the precipitous glaciers on the east coast, as regards number and extent, possibly undergo some change in the course of centuries?

The Southern Glacier is not to be found on any of the earlier maps of Jan Mayen, nor is it mentioned in the accounts of the island given in the "Zeespiegel" and by Zorgdrager and Scoresby. The first to call attention to this glacier was Vogt, whose map, views, and general account of the island closely agree with our own observations.

esse for de gamle Hvalfangere i det 17de Aarhundrede, men paafaldende er det unegtelig, at Scoresby, der roede langs denne Kyst den 4de August 1817 og var iland paa Toppen af Krater Esk samme Dag, ikke omtaler denne betydelige Bræ, der danner et saa fremtrædende Træk i Landskabet. Se Vogt's Beretning og vort Billede. Er ogsaa den en nyere Tids Dannelse?

Med Hensyn til Krater Esk og Krater Vogt maa jeg bemerke, at jeg efter nøjagtig Gjennemgaaen af Scoresby's og Vogt's Beretninger er kommen til det bestemte Resultat, at disse Forskere have besteget forskjellige Kratere. Vogt beretter nemlig, at han besteg Scoresby's Krater Esk. De ældre Karter give ingen Vejledning, da disse Gjenstande ikke ere af nogen hydrografisk Interesse. Scoresby siger (I, Side 162), "at han fra Krater Esk saa ved Foden af Bjerget paa Sydostsiden, i Nærheden af en vældig Lavastrækning, et andet Krater med Rand som én Murtinde, af lignende Form som det ovenfor beskrevne (Esk)." Begge Kratere ere angivne paa hans Kart, det vestligste betegnet "Esk Mount, a Volcano". Vogt saa fra det Krater, han besteg, nede paa det lave Forland det lave Askekrater "Berna", der neppe hæver sig over Sletten, og paa Vogt's Kart er Scoresby's andet Krater udeladt og "Berna" sat istedet. Efter hvad jeg, som ovenfor nævnt, til forskjellige Tider kunde se, findes alle 3 Kratere, saaledes som paa vort Kart angivet. Der er i Vogt's Beskrivelse, saavidt jeg kan se, Intet i Vejen for at antage, at det Krater, Scoresby saa tydelig fra Toppen af "Esk", er det, som Vogt har besteget. Jeg har ogsaa tilladt mig at give dette Krater Navn efter denne Forsker, hvis Rejse til Jan Mayen i saa høj Grad har udvidet vor Kundskab om denne Ø, og hvis Beskrivelse deraf havde orienteret mig i Forvejen i den Grad, at jeg under vort Besøg dér havde en Følelse, som om det var en tidligere kjendt Egn, jeg var kommet til.

Ægøen er i "Zeespiegel", hos Zorgdrager og hos Scoresby fremstillet som en fra Hovedlandet ved et Sund adskilt virkelig Ø. Vogt's Kart forbinder den med Land ved en ganske smal Tange. Vi saa den som en fuldstændig Halvø. Man se Fig. 2 óg Kartet. Scoresby's Cape Brodrick, Pynten indenfor Sundet, er saaledes forsvundet mellem 1817 og 1861, idet Øen er bleven forbundet med Land. Landtangen, der nu er lige saa bred som Ægøen selv, ligger adskillige Meter over Havspejlet.

Lagunen paa Vestsiden omtales i "Zeespiegel" og forekommer paa Kartet saavel her som i Zorgdrager's og i Scoresby's Verker. Paa Vogt's Kart er den bleven udeglemt. Den korte Beskrivelse i "Zeespiegel" stemmer godt med mine Iagttagelser paa Stedet. Den lange Lagune paa Østsiden derimod findes ikke i nogen af de ældre Beskri-

Off the coast, the navigation is here, according to the earlier accounts, a good deal incumbered with rocks and shoals; and hence, possibly, the old whalers of the 17th century did not attach any hydrographical importance to the glacier. It is however undeniably strange, that Scoresby, who on the 4th of August rowed along this part of the coast, and the same day ascended to the summit of Mount Esk, should not have mentioned so considerable a glacier, forming as it does a prominent feature of the scenery (see Vogt's account and our view). Can this, too, be a later formation?

As regards the Esk crater and the Vogt crater, I feel convinced, from a careful perusal of Scoresby's and Vogt's accounts, that the said explorers must have ascended different craters. According to Vogt's statement, he ascended the Esk crater (Scoresby's). The earlier maps afford no assistance in deciding this doubtful point, since such details, being without hydrographical interest for the navigators of that time, were not laid down. Scoresby, who had ascended the Esk crater, states (page 162), that "at the foot of the mount, on the south-east side, near a stupendous accumulation of lava, bearing the castellated form, was another crater, of similar form to the one above described." Both craters are to be found on his map, the most westerly of the two being designated "Esk Mount, a Volcano." Looking down from the crater he had ascended, Vogt saw beneath him, on the low-lying foreland, the low Berna crater, which hardly rises above the surrounding tract; and on Vogt's map Scoresby's second crater has been left out and the Berna crater substituted in its place. As previously stated, according to what I observed at different times, all 3 craters are to be found, in the respective positions given them on our map. In Vogt's account there is nothing, so far as I can judge, to oppose our assuming that the cone which Scoresby distinctly observed from the summit of Mount Esk is that ascended by Vogt. I have likewise made free to give this crater the name of the explorer whose voyage to Jan Mayen has so largely contributed to extend our knowledge of that interesting island, and whose accurate account had rendered me so familiar with its topography, that during our sojourn there I had frequently the impression of being in a country I had visited before.

Both in the "Zeespiegel" and in the maps by Zorgdrager and Scoresby, Egg Island is represented as a veritable island, cut off by a sound from the main land. On Vogt's map, an exceedingly narrow strip of land connects, it with the main island. As *we* beheld "Egg Island," it was in every respect a peninsula; see Fig. 2 and the Map. Scoresby's Cape Brodrick, the point lying within the sound, must accordingly have disappeared some time between the years 1817 and 1861. The isthmus, which is now equal in breadth to Egg Island itself, rises a score or so of feet above the sea-level.

The lagoon on the west side is mentioned in the account of the island given in the "Zeespiegel," and may be found on the map accompanying that work, as also on the maps by Zorgdrager and Scoresby. On Vogt's map it has been left out. The brief description in the "Zeespiegel" agrees closely with my own observations. On the other

velser eller Karter. "Zeespiegel" har paa dette Sted to lange Bugter, Store og lille Rækved-Bugt ("Groote Hout bay" og "Cleyne Hout bay"), adskilte ved en til Havet gaaende Bergmasse. Denne er aabenbart den samme som vi kaldte "Støtten", og som sees saavel paa vort Billede af Lagunen som paa det tilsvarende Billede Side 282 hos Vogt. I Bugten har "Zeespiegel" en flad Fjære af Sand, dækket med Rækved, og i Havet udenfor er der temmelig grundt, 6, 7 og 8 Favne indtil $1^1/_2$ Kvartmil fra Stranden. Zorgdrager og Scoresby har det samme. Scoresby fortæller, at, da han var paa Toppen af "Esk", "var, mod Sydvest, hele Øens Udstrækning synlig", men nævner ikke et Ord om Lagunen, og har den heller ikke paa sit Kart. Fra Toppen af sit Krater beretter Vogt, at han saa Lagunen i hele dens Udstrækning, og fra "Esk" skulde den være lige saa godt synlig. Man tør herefter med Vogt trygt slutte, at Lagunen er dannet mellem begge Forskeres Besøg, mellem 1817 og 1861. Jeg tror snarere, at den er dannet ved at den lave Sandvold, som adskiller den fra Havet, efterhaanden er opkastet af Brændingen, end, som Vogt antager, at Lagunens Flade tidligere var dækket af "Bankisen". Ægøens Forbindelse med Land staar aabenbart i nøjeste Forbindelse med Lagunvoldens Fremkomst over Havspejlet; thi Ægøens Landtunge udgjør den directe Fortsættelse af Lagunvolden. En Hævning af Landet her er ikke utænkelig, men paa den anden Side af Øen, ved den vestre Lagunes Vold, er der, naar "Zeespiegel"s Beskrivelse fra Midten af det 16de Aarhundrede sammenholdes med mine ovenfor nævnte Iagttagelser, ikke noget Tegn til nogen merkelig Hævning. Paa vor Kundskabs nærværende Standpunkt kunne Gjætninger lige saa lidet hjelpe os her som ved Spørgsmaal om Jan Mayens Isbræers Forandringer.

hand, the long lagoon on the east side is not mentioned in the earlier accounts of Jan Mayen, nor does it appear on any of the annexed maps. In the "Zeespiegel," this part of the coast exhibits two long bights, — Great Wood Bay and Little Wood Bay ("Groote Hout bay" and "Cleyne Hout bay"), disconnected by a rocky mass stretching between them down to the sea. It is evidently this cliff to which we have given the name of "Søjlen" (the pillar), and which appears both in *our* view of the lagoon and in that given on page 282 of Vogt's work. In the "Zeespiegel," the bay has a flat sandy beach covered with driftwood, and the water is shallow — 6, 7, and 8 fathoms — to the distance of a mile and a half from the shore. The same details are given in the maps by Zorgdrager and Scoresby. Scoresby states, that from the summit of Mount Esk, "towards the south-west the utmost extent of the island was visible;" but he does not say a word about the lagoon, nor is that prominent feature of the coast to be found in his map. From the top of the crater bearing his name, Vogt could overlook the lagoon in its full extent, and the same should be the case from the summit of Mount Esk. Hence, it would be reasonable to infer with Vogt, that the lagoon has been formed between the visits of the two explorers, or some time during the interval extending from 1817 to 1861. Meanwhile, the origin of the lagoon must, I think, be ascribed to the low sand-barrier stretching between it and the sea having been gradually thrown up by the action of the surf, rather than, as Vogt surmises, to the possible fact of its surface having in former times been covered with "bank-ice." The conversion of Egg Island to a peninsula is beyond doubt closely connected with the appearance of the lagoon barrier above the sea-level, since the Egg Island isthmus constitutes the direct continuation of the said barrier. True, there may have been a rise along this part of the coast; but on the other side of the island, if the account given in the "Zeespiegel" from the middle of the 16th century be compared with the results of my own observations, there can hardly have been a perceptible rise at the barrier of the western lagoon. At the present stage of research, hypothetical deductions are as futile here as in questions bearing on a presumptive change in the number and position of Jan Mayen's glaciers.

De af Havet opragende Klipper "Lodsbaaden" og "Fyrtaarnet" ligge efter vore Maalinger og Tegninger som paa vort Kart angivet. De findes begge omtalte i "Zeespiegel" og afsatte paa Kartet deri som "Klip als een Seyl". Deres Beliggenhed er rigtigere paa det gamle hollandske Kart end hos Scoresby, der lægger "Lodsbaaden" for langt mod Syd og "Fyrtaarnet" for langt fra Land.

The two rocks rising abruptly from the sea called respectively the "pilot-boat" and the "light-house," have, according to our observations and drawings, the position given them in the annexed Map. They are both mentioned in the "Zeespiegel," and laid down on the map accompanying that work as "Klip als een Seyl." The old Dutch geographer has placed these rocks more correctly than Scoresby, on whose map the "pilot-boat" lies too far south and the "light-house" too far from the shore.

Guinea-Bugtens nordligste Pynt stikker, ifølge vore Skitser, mere frem end paa Scoresby's Kart. Heri stemme vi bedre overens med "Zeespiegel".

The most northerly point of Guinea Bay projects, according to our drawings, farther out than it does on Scoresby's map. In this detail we agree better with the "Zeespiegel."

Vogel-klip ligger ifølge "Zeespiegel" lige udenfor Vestpynten af Syd-Bay, ikke som hos Scoresby i Sydvest for denne. "Naar man ligger paa 15 Favne Vand i Syd-

Vogel-klip lies according to the "Zeespiegel" just without the west point of South Bay, not as on Scoresby's map to the south-west of that bight. "When anchored in

Bay, saa ser man ud mellem Vogel-klip og Landet."

Et Stykke fra Hoepstock's Bay "finder man et Nes, tvers af hvilket der ligger nogle Klipper, som kaldes *de Rudsen*"[1] ("Zeespiegel").

"Walrusch Gat" kaldes Kløften udenfor det Nes, som skyder ud paa Nordsiden af English Bay, og udenfor hvilket det "Brielske Taarn" staar. Se Fig. 3.

Strax vestenfor Mary Muss Bugt staar paa "Zeespiegel"s og Zorgdragers Kart en af Havet opragende Klippe. Nogen saadan saa vi ikke, men vel et Skjær, over hvilket Søen brød. Klippen er styrtet i Havet.

Paa Kartet i "Zeespiegel" stikker Fugleberget frem som et langt Nes mod Nord. I Beskrivelsen hedder det: "Fra Østpynten af Mary Muss Bay skyder en Bergfod fra Landet ud i Søen, meget stejl og høj ved sin Vest-Strand. Nu er der intet saadant udskydende Nes. Men der ligger en Boe udenfor Fugleberget.

Af Sidekratere paa Jan Mayen have vi observeret flere end der er aflagt i de ældre Karter. Jeg henviser til Rejsebeskrivelsen ovenfor og Kartet samt Billederne. De paa Kartet som Kratere betegnede Fjeldtoppe, der ikke ere omtalte i Rejsebeskrivelsen, ere aflagte efter Tegningerne og ere antagne, paa Grund af deres Form, der er eller nærmer sig den koniske, for at svare til dette Navn.

Adskilt ved dybe Have fra alle nærmeste Lande ligger Jan Mayen ensom ude i Grønlandshavet. Mellem Norge og Jan Mayen er Havet 1760 Favne dybt, mod Spidsbergen over 2000 Favne, mod Grønland over 1300 Favne og mod Island over 1000 Favne dybt. Øens Retning er fra NE. t E.—SW. t W., den peger mod Danmarkstrædet og ligger parallel Heklas Vulkanlinie. Den er efter alt hvad derom er blevet observeret, bygget udelukkende af vulkanske Bergarter, og disse synes alle at tilhøre den moderne Vulkanisme. Den er saaledes yngre end Færøerne og Island, hvor ældre vulkanske Bergarter ere eneraadende eller danne Grundvolden. Dens Længde er lidt over $7^1/_2$ geografisk Mil. Den dannes af to større Dele, den nordlige og den sydlige, der ere forenede ved en lavere og smalere Landstrækning. Den nordlige Dels største Bredde er lidt over 2 geografiske Mile, den sydliges $1^1/_2$ geografisk Mil, og paa det smaleste Sted er Bredden $1^1/_2$ Kvartmil

[1] Rudsen = fr. roche = Klippe.

15 fathoms in South Bay, you look out between Vogel-klip and the land."

A short distance from Hoepstock's Bay "there is a noss, or promontory, off which are seen a few rocks, called *de Rudsen*"[1] ("Zeespiegel").

"Walrusch Gat" is the name given to the chasm lying without the promontory that juts forth on the north shore of English Bay, and beyond which rises "Brielle Tower" (see Fig. 3).

A little west of Mary Muss Bay, both on the map in the "Zeespiegel" and on that by Zorgdrager, there is a rock projecting abruptly out of the sea. We could discover no such rock; but we saw a shoal over which the sea was breaking. The rock in question must at some later period have toppled down into the sea.

On the map in the "Zeespiegel," the Fugleberg projects towards the north as a long noss, or headland, described in the account as follows: — "From the east point of Mary Muss Bay, the base of a mountain, very lofty and precipitous on its west side, juts out from the land into the sea." *Now* there is no such projecting promontory. A sunken rock, however, lies off the Fugleberg.

Of parasitic craters on Jan Mayen, we observed a greater number than are given in the earlier maps of the island. For further information on this head, the reader is referred to the above account of our exploratory work, as also to the Map and the illustrations. The mountain summits marked on the map as craters, though not mentioned in the account of the island, have been laid down from sketches, and are, by reason of their form, which is more or less conical, presumably entitled to the name.

Cut off on all sides by extensive ocean tracts from the nearest land, the Island of Jan Mayen occupies an isolated position in the Greenland Sea. Between Norway and Jan Mayen the depth reaches 1760 fathoms, towards Spitzbergen upwards of 2000 fathoms, towards Greenland upwards of 1300 fathoms, and towards Iceland upwards of 1000 fathoms. The direction of the island is from NE. by E. to SW. by W.; it points towards Denmark Strait, and lies parallel to the volcanic line of Mount Hecla. As previously stated, Jan Mayen is built up of volcanic rocks, all of which would appear to belong to the modern group. Hence the island is probably a later formation than are the Færoes and Iceland, where the old volcanic rocks prevail either exclusively or in greater part. Its length slightly exceeds $7^1/_2$ geographical miles. It consists of two large parts or divisions, a northern and a southern, connected together by a lower and narrower tract. The greatest

[1] Rudsen: Fr. roche: rock.

150 à 200 Meter. Fugleberget er maalt til 150 Meter, Ægøen anslaaet til c. 150 Meter.

Beerenbergs Basis er, som paavist af Carl Vogt, bygget af Lavalag og tildels Tuflag, der synes at have flydt eller være kastet ud af det store Central-Krater, sandsynligvis førend dette havde opbygget den øvre Askekegle. Af lignende Bygning er Øens Midtparti og efter Udseendet at dømme ogsaa den sydlige Del. Ovenpaa denne store sammenhængende Lavamasse staa en Mængde smaa Sidekratere, der for en stor Del have bevaret en udpræget konisk Form. Saadanne ere Krater Sars, Krateret øst for Sydbræen, Kraterne Esk og Vogt, Kraterne Danielssen og Blytt og Kraterne ved Guineabugten. Forstyrrede i sin Form ere Fugleberget paa Vestsiden og Ægøen paa Østsiden; idet begges ydre Kraterrand er opslugt af Havet. Nogle af Sidekraterne ere byggede af Lava og have udsendt betydelige Lavastrømme, som Vogt, Esk, nogles Top er bygget af løse udkastede Masser, Slakker og Aske, Rapilli, som Kraterne ved Mary Muss Bugten, ved Guineabugten, andre af Tuflag, Tufconglomerater og faste Lavalag, som Fugleberget, og atter andre af Aske alene, som Ægøen og Berna.

Den vulkanske Hovedspalte, hvorpaa Jan Mayen er bygget, gaar aabenbart efter Øens Længderetning, efter Heklalinien. Men Sidekraternes Gruppering synes at give en Antydning af, at der har været Tverspalter i Retningen WNW.—ESE. Vi have nemlig i denne Retning, som det synes, flere Rader af Sidekratere, saasom Esk—Vogt—Berna, Fugleberg—Egø, Hoyberg—Krater ved Fyrtaarnet (?). Er det et Tilfælde, at Endekrateret mod SE. i de to første Rækker, Berna og Ægø, kun have udkastet Aske?

Af Dale gives der paa Jan Mayen ingen af større Længde; de større Dale paa Nordlandet ere fyldte af Bræerne og Sydlandet synes at være meget lidet indskaaret af Dale. Af Bække ere kun faa iagttagne.

Karakteristiske for Jan Mayens Kyst ere de paa mange Steder opstaaende Klipper i Havet, hvoraf vi ovenfor have nævnt flere. De ere vistnok for største Delen Rester af Lavastrømme, der ere gaaede ud i Havet.

Jan Mayens Kyster ere, som ovenfor berørt, paa mange Steder meget bratte og høje. Paa andre Steder er der et lavt Forland, bestaaende af Lava, dækket tildels med Sand. Dette Forland, som paa Kartet har sin særegne Betegnelse, ligger tildels saa lavt, at det er dækket med Rækved. Lave Strender, af Sand, ere ogsaa mangesteds tilstede, og indeholde store Mængder af Rækved, Kjæver og Hvirvler af Hval, Vraggods og opkastet Tang.

reach a height of 400 to 600 feet. The altitude of Fugleberg we found by observation to be 490 feet; that of Egg Island was estimated at 400 to 500 feet.

As shown by Carl Vogt, the base of Mount Beerenberg is composed partly of layers of lava, and partly of layers of tuff, that would appear to have flowed or been discharged from the great central crater previous to the formation of the upper cone of ashes. The middle tract of the island exhibits a similar structure, and to judge from its appearance, also the southern part. Above this stupendous mass of lava rise a number of small parasitic craters, the greater part of which have retained a conical form. Such, for instance, are Sars's crater, the crater east of the southern glacier, the Esk and Vogt craters, Danielssen's and Blytt's craters, and the craters in the vicinity of Guinea Bay. Fugleberg on the west coast and Egg Island on the east, are no longer conical, the outer edge of the crater having given way and fallen into the sea. Some of the parasitic craters are built up of lava, and would appear to have sent forth considerable currents, as the Vogt and Esk craters; the summit of others consists of loose erupted masses, cinders, and ashes (rapilli), as the craters in the vicinity of Mary Muss Bay and Guinea Bay; others are composed of layers of tuff, tuff-conglomerate and compact masses of lava, as the Fugleberg, and others again of ashes alone, as Egg Island and the Berna crater.

The chief volcanic fissure in which Jan Mayen Island is built, must obviously extend in the longitudinal direction of the land, parallel to the volcanic line of Mount Hecla. Meanwhile, the grouping of the parasitic craters would seem to intimate the existence of transverse fissures running from WNW. to ESE.; for in that direction there are, apparently, several rows of parasitic craters, as the Esk, Vogt, Berna, the Fugleberg and Egg Island, Hoyberg and the crater in the vicinity of the "pilot-boat" (?). Must we regard it as mere accident that each of the terminal craters towards the south-east in the two first rows should have discharged ashes alone?

Jan Mayen has no valleys of considerable extent; the large ravines in the northern part of the island are filled with glaciers, and the southern land would appear to be but little intersected by vales or ravines. Of brooks or rivulets, very few have been observed.

A characteristic feature distinguishing the coast of Jan Mayen, are the fantastic-shaped rocks that in many places rise abruptly from the sea, of which we have mentioned several. They are no doubt in greater part fragments of lava detached from currents that had flowed into the sea.

The coasts of Jan Mayen are, as previously stated, in many places lofty and precipitous. In some localities, however, there is a low expanse of foreshore consisting of lava, partially covered with sand. This foreshore, which is separately marked on the Map, lies so low in places as to be covered with driftwood. Some localities, too, exhibit a low sandy beach, bestrewn with large quantities of driftwood, the jaws and vertebræ of whales, bits of wreck, and sea-weed.

Intetsteds paa Øen findes en Havn, der kan yde et Skib eller en Baad Ly i alle Slags Vejr.[1] Landgang paa Øen er derfor mulig kun naar Søen er forholdsvis rolig, men dette er vistnok en Sjeldenhed, undtagen naar Havisen ligger rundt om Øen.

Merkværdige ere de to Laguner, der ere adskilte fra Havet ved Volde af sort Sand, kun nogle faa Meter høje, et Par hundrede Skridt brede, som føre ferskt Vand og hvis Spejl kun ligger ubetydeligt højere end Havet. Vestsidens Lagune er saa dyb, at den vilde kunne give en god Havn, om Tangen blev gjennembrudt i tilstrækkelig Dybde. Østsidens Lagune er mindre dyb.

Jan Mayen ligger ganske i den østgrønlandske Polarstrøm. Under 10 til 20 Favne er Havets Vand hele Aaret igjennem iskoldt. Om Vinteren er der ofte aabent Vand ved Jan Mayen; navnlig passere Sælfangerne jevnlig vestenom Øen. Sommeren er kold, en naturlig Følge af det iskolde Vand.

Den nordlige Del af Jan Mayen er dækket af evig Sne indtil en Højde af omkring 700 Meter. Beerenbergs Kegle er snedækt undtagen paa de bratteste Steder, hvor den sorte Fjeldvæg træder frem. Beerenbergs Basis er dækket af en udstrakt Snekaabe, hvorfra vældige Isbræer skyde sig ned, af hvilke 9 store Bræer naa helt til Havet.

Sydlandet synes ikke at være glacieret. Store Sneflekker findes om Sommeren overalt paa Øen i Nærheden af Havet.

Jan Mayens Flora er fattig. Men det Grønne mangler ikke, tvertimod danner Mosernes grønne Teppe, der dækker store Partier, en udmerket malerisk Contrast til Bergarternes sorte, brune og røde Farver. De af Dr. Danielssen paa Ejdet i Syd for Mary Muss Bugten samlede Planter ere, ifølge Bestemmelse af Professor *A. Blytt*, følgende:

Saxifraga cæspitosa, L.
— *nivalis*, L.
— *oppositifolia*, L.
— *rivularis* L.
Ranunculus glacialis, L.
Halianthus peploides, Fr.
Cerastium alpinum, L.?
Draba corymbosa, R. Br.
Cochlearia officinalis, L.
Oxyria digyna, Campd.
Catabrosa algida, Fr.

Af *Pattedyr* findes Fjeldrakken, *Canis lagopus*, i ikke ganske ringe Antal paa Jan Mayen. Den synes at nære sig af Søfugl. Af Fugle har Hr. Friele noteret følgende Arter:

[1] Lille Sandbugt synes efter Beskrivelsen i Zeespiegel at afgive en god Baadhavn, dækket af udenfor liggende Skjærgaard.

Nowhere on the shores of Jan Mayen has a harbour been found that could afford a ship or a boat shelter in all kinds of weather.[1] Hence, to land is possible only with the sea comparatively smooth, which it rarely is save when drift-ice encompasses the island.

Specially noteworthy are the two lagoons, cut off from the sea by barriers of black sand, only a few feet high and a couple of hundred paces broad. They both contain fresh water, the surface of which lies but very little above that of the sea. The lagoon on the west side of the island is deep enough to afford a good harbour were the barrier cut through to a sufficient depth. The lagoon on the east side is comparatively shallow.

Jan Mayen lies wholly within the Greenland Arctic current. At a depth of from 10 to 20 fathoms, the temperature of the sea is all the year round below zero. In the winter there is frequently open water off the coasts of Jan Mayen, sealers often passing to the west of the island. The summer is naturally cold, from the presence of ice-cold water so near the surface of the sea.

The northern part of Jan Mayen rises, at a height of about 2300 feet, into the region of perpetual frost. The upper cone of Mount Beerenberg is snow-capt, save on the steepest parts of its declivity, where the black mountain-wall is seen protruding. The base of Beerenberg is girt with a belt of snow, from which prodigious glaciers take their origin, 9 of the largest reaching down to the water's edge.

The southern part of the island would not appear to be glaciated. Large patches of snow are everywhere observed throughout the summer in the vicinity of the sea.

Jan Mayen has but a meagre Flora. Bright herbage, however, is not wanting; the green carpet of moss, in places of considerable extent, forms a striking and pleasant contrast to the black, brown, and red of the surrounding rocks. The plants collected by Dr. Danielssen on the isthmus south of Mary Muss Bay, are, according to Professor *A. Blytt*, as follows: —

Saxifraga cæspitosa, L.
— *nivalis*, L.
— *oppositifolia*, L.
— *rivularis*, L.
Ranunculus glacialis, L.
Halianthus peploides, Fr.
Cerastium alpinum, L.?
Draba corymbosa, R. Br.
Cochlearia officinalis, L.
Oxyria digyna, Campd.
Catabrosa algida, Fr.

Of mammiferous animals, the Polar fox, *Canis lagopus*, is by no means rare on Jan Mayen. Of birds, Mr. Friele has noted the following species: —

[1] Little Sand Bay would appear, according to the account in the "Zeespiegel," to be a good harbour for boats, protected as it is by an outlying chain of islets.

Somateria mollissima, Leach. Sjelden.
Larus glaucus, Brün. Almindelig.
Fulmarus glacialis, Lin. Overordentlig talrig.
Grylle Mandti, Licht. Talrig.
Uria arra, Schlegel. Talrig.
Mergulus alle, Lin. Talrig.
Tringa maritima?

Er Landets Fauna fattig, er derimod Havets desto rigere, hvorom Vidnesbyrd vil foreligge i samtlige zoologiske Afhandlinger i denne Generalberetning.

Bemerkninger til Kartet.

Kartprojectionen er Mercators. Maalestokken 1:200,000. Navnene paa Kartet ere alle paaførte af mig. Jeg har for det første beholdt alle de gamle hollandske Navne, i Originalsproget eller oversatte. Dernæst har jeg beholdt alle de af Scoresby og Carl Vogt givne Navne. Og endelig har jeg tilføjet en Del nye Navne. Disse ere: *Weyprechts Bræ*, til Minde om den fremragende Polarfarer, hvis store Plan til Undersøgelse af Polarlandenes fysiske Forhold nu bliver realiseret; *Kjerulfs Bræ*, efter den berømte norske Geolog; *Foyns Bræ*, efter Capt. Svend Foyn, der var den første Nordmand, som gik i Spidsen for de Norskes Sælfangst ved Jan Mayen; *Krater Sars*, efter Expeditionens Medlem, Prof. G. O. Sars; *Clandeboye Creek*, det Punkt, hvor Lord Dufferin var i Land (efter velvillig skriftlig Meddelelse fra Lord D.; se ogsaa "Letters from High Latitudes", Side 165); *Lord Dufferins Bræ; Frieles Bræ, Griegs Bræ, Willes Bræ, Petersens Bræ, Schiertz's Top*, efter Deltagerne i vor Expedition; *Krater Vøringen*, efter Expeditionens Skib; *Høsaaten*, det lille Krater i Nærheden af *Hoyberg* (et Navn, der betegner et Tag over en Høstak, der minder om den regelmæssige Kegleform[1]); *Krater Danielssen*, efter Expeditionens Medlem, Dr. Danielssen, der botaniserede her; *Krater Blytt*, efter Prof. A. Blytt, der har bestemt de paa Jan Mayen indsamlede Planter; *Tornøes Bæk*, efter Expeditionens Medlem, Chemikeren H. Tornøe, som fandt denne, ret vandrige Bæk; *Scoresby's Berg*, efter den berømte Hvalfanger, hvem Jan Mayens Geografi skylder saa meget.

[1] Meddelelse af Dr. Snellen i Utrecht.

Somateria mollissima, Leach. — Rare.
Larus glaucus, Brün. — Common.
Fulmarus glacialis, Lin. — Exceedingly abundant.
Grylle Mandti, Licht. — Abundant.
Uria arra, Schlegel. — Abundant.
Mergulus alle, Lin. — Abundant.
Tringa maritima?

If the land Fauna of the island is meagre, that of the sea is proportionately rich, a fact which the numerous zoological Memoirs published in this General Report will sufficiently attest.

Remarks on the Map.

The Map is on Mercator's projection, scale $\frac{1}{200000}$. All of the names are selected by myself. First, I have chosen to retain the old Dutch names, either in the original language or translated. Secondly, I have kept all the names given by Scoresby and Carl Vogt. And finally, I have added new names, viz. *Weyprecht's Glacier*, in memory of the renowned traveller, whose comprehensive plan for the investigation of the physical conditions of the Arctic Regions is now in course of realisation; *Kjerulf's Glacier*, after the celebrated Norwegian geologist; *Foyn's Glacier*, after Captain Svend Foyn, the first of his countrymen who started a Norwegian sealing fishery off the coasts of Jan Mayen; *Sars's Crater*, after Professor G. O. Sars, member of the Expedition; *Clandeboye Creek*, the spot where Lord Dufferin landed (as kindly communicated by that nobleman from Constantinople; see, too, "Letters from High Latitudes," p. 165); *Lord Dufferin's Glacier; Friele's Glacier, Grieg's Glacier, Wille's Glacier, Petersen's Glacier, Schiertz's Peak*, after gentlemen who took part in the Expedition; the *Vøringen Crater*, after the name of the vessel; *Høsaaten* (haycock), the small crater in the vicinity of Mount Hoyberg (Hoyberg is a Dutch word signifying the roof of a haystack[1] that in form has some resemblance to a volcanic cone); *Danielssen's Crater*, after Dr. Danielssen, member of the Expedition, who botanised on its slope; *Blytt's Crater*, after Professor A. Blytt, who has determined the specimens of plants collected on Jan Mayen; *Tornøe's Rivulet*, after Mr. H. Tornøe, chemist to the Expedition, who on one of our excursions found this for Jan Mayen copious spring of water; *Mount Scoresby*, after the enterprising British whaler to whom the geography of Jan Mayen is so greatly indebted.

[1] Communicated by Dr. Snellen of Utrecht.

Fra Hr. *H. Reusch,* Assistent ved den geologiske Undersøgelse, har jeg modtaget følgende Meddelelse om hans mikroskopiske Undersøgelse af nogle Bergarter fra Jan Mayen.

De Haandstykker fra Jan Mayen, som De velvilligen har tilstillet Universitetets Mineralkabinet, har jeg efter Professor Kjerulfs Opfordring undersøgt mikroskopisk. Der foreligger *Basalter* (Rosenbusch's Definition). Herved er dog at bemærke, at Olivinen, idetmindste tildels, er tilstede i noget ringe Mængde, og at Plagioklasen, i Modsætning til, hvad der for det meste finder Sted hos de ægte Basalter, for en Del forekommer porfyrisk indsprængt i større Individer. Alligevel har jeg ikke kunnet beslutte mig for Navnet Augitandesit.

Fire af Haandstykkerne, No. 4, 5, 6, 7, var temmelig ens; med blotte Øjne betragtet foreligger en temmelig rigelig, af smaa tomme Blærerum opfyldt, tæt, mørkegraa Bergart, hvori man ser fremskinne fine Feldspatlister og enkelte større Feldspatkrystaller, samt ogsaa bemærker en eller anden Augitkrystal, undtagelsesvis endelig ogsaa et lidet Korn grønlig Olivin.

Under Mikroskopet ser man en forholdsvis lidet finkornet Grundmasse af langstrakte Plagioklaskrystaller og mere rundagtige Augitindivider, fremdeles mørkt slaggeagtigt Glas og Korn af en mørk Jernerts. Udskilt i større, porfyrisk indsprængte Krystaller forekommer Plagioklas og Augit, hvilken sidste som Grundmassens er lys brunlig-grøn, meget svagt pleochroistisk. Hist og her i Præparaterne opdager man indsprængte større Olivinkrystaller, der er saagodtsom aldeles friske og for en stor Del omgrændsede af distincte Flader.

I de større Krystaller af de sidstnævnte tre Mineraler sees gjerne Glasindeslutninger og Jernertskorn, i Olivinen tillige Picotit (?).

De som No. 2 og 3 mærkede Haandstykker var ikke porøse og indeholdt talrigere samt mere fremtrædende porfyrisk udskilte Krystaller end foregaaende. I Grundmassen var Augiterne meget smaa; Jernerts var rigelig tilstede; lidt Biotit bemerkedes; Glas saa man kun lidet til. Derimod indeholdt de udskilte større Plagioklaskrystaller Indeslutninger af saadant som ogsaa af Grundmassen i vakkert rectangulært omgrændsede Partier. En paafaldende Finkornethed udmærkede den Olivinkrystallerne nærmest omgivende Del af Grundmassen, i hvilken forresten i dette lige saa lidt som i foregaaende Tilfælde Olivin bemærkedes som egentlig Bestanddel. Olivinen var dels omgrændset af Flader, dels havde den ujevne Omrids, dels endelig trængte Grundmassen med ujevnt conturerede, undertiden udpræget sækformede Forgreninger ind i dem. Disse Forgreninger var finkornede eller vel oftere et slaggeagtigt Glas, hvilket ogsaa gjerne optraadte i den til Krystallerne ellers allernærmest stødende Del af Grundmassen. Hosstaaende tre Figurer, der er tegnede ved 360 Ganges Forstørrelse, illustrerer nøjere dette Forhold. For Tydeligheds Skyld har jeg undladt at indtegne de Sprækker og Jernertskorn,

Mr. *H. Reusch,* Assistant to the Norwegian Geological Survey, has sent me the following results of his microscopical examination of divers rock-specimens from the island of Jan Mayen.

The rock-specimens from Jan Mayen which you kindly forwarded to the Mineralogical Museum of the University, I have, at Professor Kjerulf's request, submitted to microscopic examination. They are *basalt* (Rosenbusch's definition). I must, however, observe, that in some cases olivine is present in no great proportion, and that plagioclase, as an exception to the general rule in true basalt, occurs here and there porphyrically imbedded in crystals of considerable size. Nevertheless, I cannot decide for augite-andesite.

Four of the specimens, Nos. 4, 5, 6, and 7, are comparatively uniform in appearance. To the naked eye, their aspect is that of a dark-grey rock exhibiting numerous empty vesicles, together with glistening lines of feldspar and several large crystals of that substance; one or two crystals of augite may be likewise observed, and finally minute isolated granules of greenish olivine.

Viewed under the microscope, is seen a comparatively coarse base of elongated plagioclase crystals, along with crystals of augite, rounder in form, dark slaggy glass, and grains of a dark-coloured iron ore. Plagioclase and augite occur imbedded in comparatively large crystals, the latter having, in common with that of the base, a brownish-green tint; it is, too, to a very slight extent pleochroistic. Every here and there in the prepared specimens are observed comparatively large imbedded crystals of olivine, with scarcely a trace of decomposition, and having on all sides well-defined facets.

In the three last-mentioned minerals are seen cavities containing glass and grains of iron ore; in the olivine also picotite (?).

Specimens No. 2 and 3 are not porous; moreover, they differ from those described above in having a greater number of porphyrically imbedded crystals, which are also more obvious. In the base, the grains of augite are exceedingly minute; iron ore is present in great abundance; a little biotite, too, was observed, but only traces of glass. On the other hand, the large plagioclase crystals exhibited numerous cavities containing the latter substance, as also that of the base, in beautifully formed rectangular spots. The part of the base immediately surrounding the crystals of olivine exhibits a remarkably fine granulation, though for the rest, neither in these nor any of the foregoing specimens does olivine occur as a true basic constituent. The crystals of olivine have some of them plane surfaces, others irregular outlines, and some are pierced by the substance of the base with irregular, and possibly also sac-like, ramifications. These ramifications are either finely granular, or, more frequently perhaps, consist of slaggy glass, which often occurs too in the part of the base contiguous to the crystals. The three figures given below, showing the object as it appeared under the microscope

som tildels sees i Olivinkrystallerne. Det mørke med korsvise, hvide Linjer, som sees indtrængende i Olivinen er urent, slaggeagtigt Glas, det sorte Mineral i Omgivelsen er Jernertskorn.

(magnifiing 360 diameters), will supplement the verbal description. To avoid complexity in the drawing, I have left out the fissures and the grains of iron ore that are seen in some of the crystals of olivine. The dark substance, with intersecting white lines, seen piercing the olivine, is discoloured, slaggy glass, the black particles lying around, grains of iron ore.

Olivinkrystal i Basalt. — A Crystal of Olivine in Basalt, magnified.

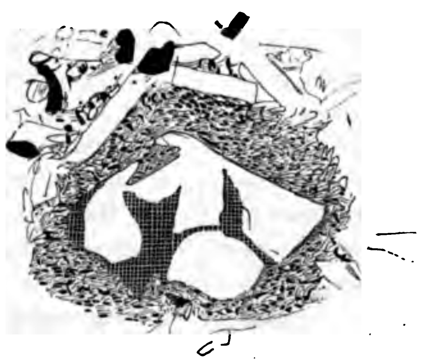
Den omgivende Bergart er paafaldende finkornet indved Krystallen og trænger i sækformede Forgreninger ind i denne.

The surrounding rock exhibits a remarkably fine granulation in immediate proximity to the crystals, which it pierces in sac-like ramifications.

Olivinkrystal i Basalt. — A Crystal of Olivine in Basalt, magnified.

Urent Glas indtrængende fra den omgivende temmelig finkornede Bergart.

Discoloured glass is seen piercing the crystal from the surrounding rock, which has a fine granulation.



Olivinkrystal i Basalt. — A Crystal of Olivine in Basalt, magnified.

Den omgivende Bergart er finkornet. Øverst paa Tegningen sees Basalt af den herskende Kornighedsgrad. Urent Glas trænger ind i Krystallen fra Omgivelsen.

The surrounding base is finely granulated. — At the top of the figure is seen basalt of the dominant degree of granulation. Discoloured glass pierces the crystal from the rock surrounding it.

Disse mikroskopiske Forhold minder unægtelig om Eruptiver, som bliver finkornede paa sine Grænser og sender finkornede Forgreninger ud i de omgivende Bergarter. Hvorvidt her foreligger et Afkjølingsfænomen er dog tvivlsomt; maaske Olivinen allerede ved sin Udkrystallisation har paavirket Grundmassen, saa den i dens umiddelbare Nærhed har stivnet hurtigere. Lignende Forhold som disse ved Olivinen beskrevne iagttages, om end mindre karakteristisk, ved de udskilte Plagioklas- og Augitkrystaller.

Haandstykket No. 8 er porøst, af en forholdsvis lys, rødliggraa Farve og indeholder udskilte Augitkrystaller. Under Mikroskop ser man, at Bergarten, som er forholdsvis lidet grovkornet og lidet rig paa mindre Augitindivider, indeholder en hel Del Olivin. Dennes Individer udhæver sig ikke synderlig i Størrelse fremfor de øvrige Bestanddele; den er ikke som i de foregaaende Tilfælde frisk, men underkastet en begyndende Serpentinisering ledsaget af Udskillelse af Jernoxyd, som er det, der gjør Bergarten rødlig. Slaggeagtigt Glas er temmelig rigelig tilstede. Nogle lange fine Naale i Feldspaten formodes at være Apatit.

Haandstykket No. 1 udmærker sig fra de beskrevne makroskopisk derved at det ingen porfyrisk udskilte Feldspatkrystaller indeholder, men derimod en Mængde smukke gulagtiggrønne Olivinkrystaller, som er indtil 0.5 cm. store.

Under Mikroskopet ser man, at Hulrummene gjerne er omgivne med en Zone af Glas. I Olivinen, der synes at være udkrystalliseret efter en anden Typus end foregaaende, bemærkes hyppig det som Picotit tydede Mineral. Den mørke Jernerts er tilstede ikke alene i rundagtige Korn, men ogsaa i stavformede Legemer. Disse forekommer som Regel nær Olivinkrystallerne og har en bestemt Stilling til disse, uanseet Bergartens øvrige paa kryds og tvers liggende Bestanddele. De staar, saavidt jeg har kunnet iagttage det, lodret mod Olivinernes Hovedakse, parallelt deres lange Biakse; de staar nemlig lodret mod deres bedste Gjennemgangsretning. Man faar Indtrykket af, at Bergartens først udskilte Bestanddele, Olivinen og Jernertsen, i den endnu plastiske Masse har ordnet sig i et bestemt Forhold indbyrdes.

These microscopic details are undeniably suggestive of eruptive rocks that exhibit a fine granulation at their limits and send forth finely granulated ramifications. Whether we have here the result of some cooling process is doubtful; possibly, the olivine acted in the course of its crystallisation upon the basic substance, thereby causing the latter in its immediate vicinity to harden sooner. A similar feature, though less characteristic than in the olivine, distinguishes the imbedded crystals of plagioclase and augite.

Specimen No. 8 is porous, of a lightish ruddy-grey colour, and contains imbedded crystals of augite. Viewed under the microscope, this rock, which, comparatively, has not a coarse granulation and exhibits but few particles of augite, contains a good deal of olivine. The crystals of the latter substance are not very large as compared with its other constituents; the olivine is not as in the foregoing specimens undecomposed, but exhibits distinct traces of serpentinisation, along with the formation of oxide of iron. This it is which gives a red colour to the rock. Slaggy glass occurs in comparative abundance. A few long thin crystals in the feldspar would appear to be apatite.

Specimen No. 1 is distinguished macroscopically from those described above, by its not containing imbedded crystals of feldspar; it exhibits, however, an abundance of beautiful yellowish-green crystals of olivine, measuring up to 0.5 cm.

Viewed under the microscope, the hollow cavities are found to be encompassed by a zone of glass. The olivine exhibits a type of crystallisation different to that observed in the other specimens, and contains a greater proportion of picotite than usual. The dark iron ore occurs not only in roundish grains, but also in rod-shaped corpuscles. These corpuscles are as a rule observed in immediate proximity to the crystals of olivine and have a definite position towards them, irrespective of the other constituents of the rock, that run in all directions. They are placed, so far as I could determine, perpendicular to the vertical axis of the crystals, and parallel to the macrodiagonal, being perpendicular to the most perfect cleavage. The first-formed constituents of the rock, olivine and iron ore, would appear to have taken up a definite position one towards the other while the surrounding mass was yet plastic.

Olivinkrystal i Basalt. — A Crystal of Olivine in Basalt.

Den i stavformede Legemer forekommende Jernerts har en bestemt Stilling i Forhold til Olivinkrystallen. Tegnet ved 360 Ganges Forstørrelse.

The iron ore occurring as rod-shaped corpuscles has a definite position towards the crystal of olivine. — Microscope magnifying 360 diameters.

3. Beeren Eiland.

Den 4de Juli 1878 kom Expeditionen tidlig om Morgenen op under Beeren Eiland. Taagen, som laa over Øens højere Dele, spredte sig efterhaanden, og om Formiddagen blev Vejret ganske klart. Vi ankrede udenfor den saakaldte "Russestue", et forfaldet lidet Hus, der dog tidligere skal have været Bolig for et overvintrende Parti. Gjennem "Borgermester-Porten"[1] roede vi ind i den lille Bugt, ved hvis inderste Bred Russestuen ligger. Vi medhavde fra Bergen en Post til den hollandske Expedition med Skonnerten "Willem Barendsz," hvilken efter den af den hollandske Consul meddelte Anvisning nedgroves, indlagt i en dobbelt Kasse, i Nærheden af Huset. Stedet merkedes med et Flag, hvorpaa stod malet: "'Vøringen' til 'Willem Barendsz'." Vi havde senere paa Sommeren den Tilfredsstillelse at erfare, at Hollænderne havde fundet sin Post.

Vort af stormende Vejr og Modvind forlængede Ophold i Østhavet tillod os ikke at offre mere end en halv Dag til et Besøg paa Beeren Eiland. Jordbunden bestod omkring Russestuen af lutter forvitret Sten, en ren "Forvitringshud," der i Frastand gav Landet et aldeles "graaskaldet" Udseende. Om Morgenen toges Skitser af Beeren-Eilands Sydvestpynt. Billeder af denne findes i Beretningerne om de Svenske Spidsbergen-Expeditioner 1861 og 1864. Da vi vare i Land om Formiddagen, og efter at være kommen ombord igjen, tog jeg Skitser af Øens højeste Fjeld, Mount Misery. Fig. 8 er skaaret efter en Tegning, der er gjort efter disse Skitser. Man ser her Beeren-Eilands Sydostpynt til Højre. Udenfor viser sig Drivis, der kommer fra Nordost. Gjennem Mount Misery gaar et horizontalt Lag af en ejendommelig fremtrædende Bergart med, som det synes, verticale Afsondringsflader. Forsaavidt man kan dømme af Udseendet alene i Frastand, synes denne Bergart at være den af Nordenskiöld benævnte Hyperit, der forekommer paa aldeles lignende Maade paa Spidsbergen og hvis Forekomstmaade sees af flere Billeder i Beretningerne om de Svenske Spidsbergens-Expeditioner.

Højden af Mount Misery's øverste Top bestemte jeg paa følgende Maade. Fra et Punkt i Land, hvor der var oprejst en liden Stenvarde, maalte jeg med Sextant Vinkelhøjden (0° 50′ 0″) af Vøringens Stormast (der efter et nøjagtigt taget Maal udgjorde 21.39 Meter). Dette giver en Afstand mellem Stenvarden og Ankerpladsen af 1470 Meter. Ved Stenvarden var Lufttrykket 744.mm0, medens det ombord, i Havets Niveau var 750.mm7. Luftens Temperatur var 5° C. Stenvardens Højde over Havet beregnes herefter til 73 Meter. Endvidere maalte jeg med Sextanten Vinkelen mellem "Vøringen" og Toppen af Mount Misery

[1] Se "Svenska Expeditionen till Spetsbergen Ar 1864 ombord paa "Axel Thordsen," under Ledning af A. E. Nordenskiöld", Side 16.

3. Beeren Eiland.

On the 4th of July, 1878, early in the morning, the Expedition reached the coast of Beeren Eiland. A thick fog, which lay over the loftiest parts of the island, gradually dispersed, and in the course of the forenoon the weather became quite clear. We anchored off the so-called "Russian Hut," an old, neglected cabin, which is said, however, to have once served as a winter abode for a party of sailors. Passing through the "Borgermester-Porten"[1] (burgomaster's gate), we rowed into the small bay at the head of which stands the Russian Hut. We had with us from Bergen a bag of letters for the Dutch Expedition with the schooner "Willem Barendsz," which, in accordance with directions given by the Dutch Consul, was now buried near the cabin, after being laid in a double case. We marked the spot with a flag, on which had been painted the words: "'Vøringen' til 'Willem Barendsz'." Later in the season we had the satisfaction of learning that the Dutch explorers had found their letters.

The boisterous weather and the succession of contrary winds that had protracted our cruise in the Barents Sea, would not admit of our devoting more than half a day to an excursion on Beeren Eiland. The ground in the vicinity of the Russian Hut consists exclusively of disintegrated stones, -- in the strictest sense a "weathered crust," which at some distance gives to the land a grey, bald appearance. In the morning we sketched the south-western promontory of Beeren Eiland. Views of this headland are given in the accounts of the Swedish Spitzbergen Expeditions in 1861 and 1864. When on shore in the forenoon, and after returning to the vessel, I sketched the highest summit of the island, Mount Misery. The view in Fig. 8 is from these sketches. To the right, we have the south-eastern headland of Beeren Eiland. Beyond, is seen drift-ice bearing down upon the island from the north-east. Traversing Mount Misery, we observe a layer of a peculiar conspicuous rock, having apparently a vertical columnar structure. To judge from its aspect at a distance, this rock would appear to be of the kind designated by Nordenskiöld as hyperite, that occurs under precisely the same conditions on Spitzbergen, and the structure of which is illustrated in several of the figures accompanying the accounts of the Swedish Spitzbergen Expeditions.

The altitude of Mount Misery was determined as follows. From a point on shore, at which a mound of stones had been erected, I measured with the sextant the angle of elevation (0° 50′ 0″) of the main mast of the "Vøringen," which, according to accurate measurement, had a height of 21.39 metres. The said angle corresponds to a distance between the mound and the anchorage of 1470 metres. At the mound, the barometric pressure was 744.mm0, whereas on board (at the level of the sea) it was 750.mm7. The temperature of the air was 5° C. From these data, the height of the mound above the sea-level was computed at

[1] See "Svenska Expeditionen till Spetsbergen Ar 1864 ombord paa 'Axel Thordsen,' under Ledning af A. E. Nordenskiöld," p. 16.

(111° 22′) og Toppens Vinkelhøjde over Horizonten (8° 40′). Horizonten bestemtes ved Hjelp af Wredes Niveller-Spejl, med hvilket jeg merkede mig et tydeligt Punkt paa Fjeldet ret under Toppen, i Stenvardens Niveau. Kommen ombord maalte jeg Vinkelen mellem Stenvarden og Toppen af

73 metres. Moreover, I measured with the sextant the angle subtending between the "Vøringen" and the summit of Mount Misery (111° 22′), as also the angle of elevation of the latter above the horizon (8° 40′). The horizon was determined by means of Wrede's levelling-mirror, with which

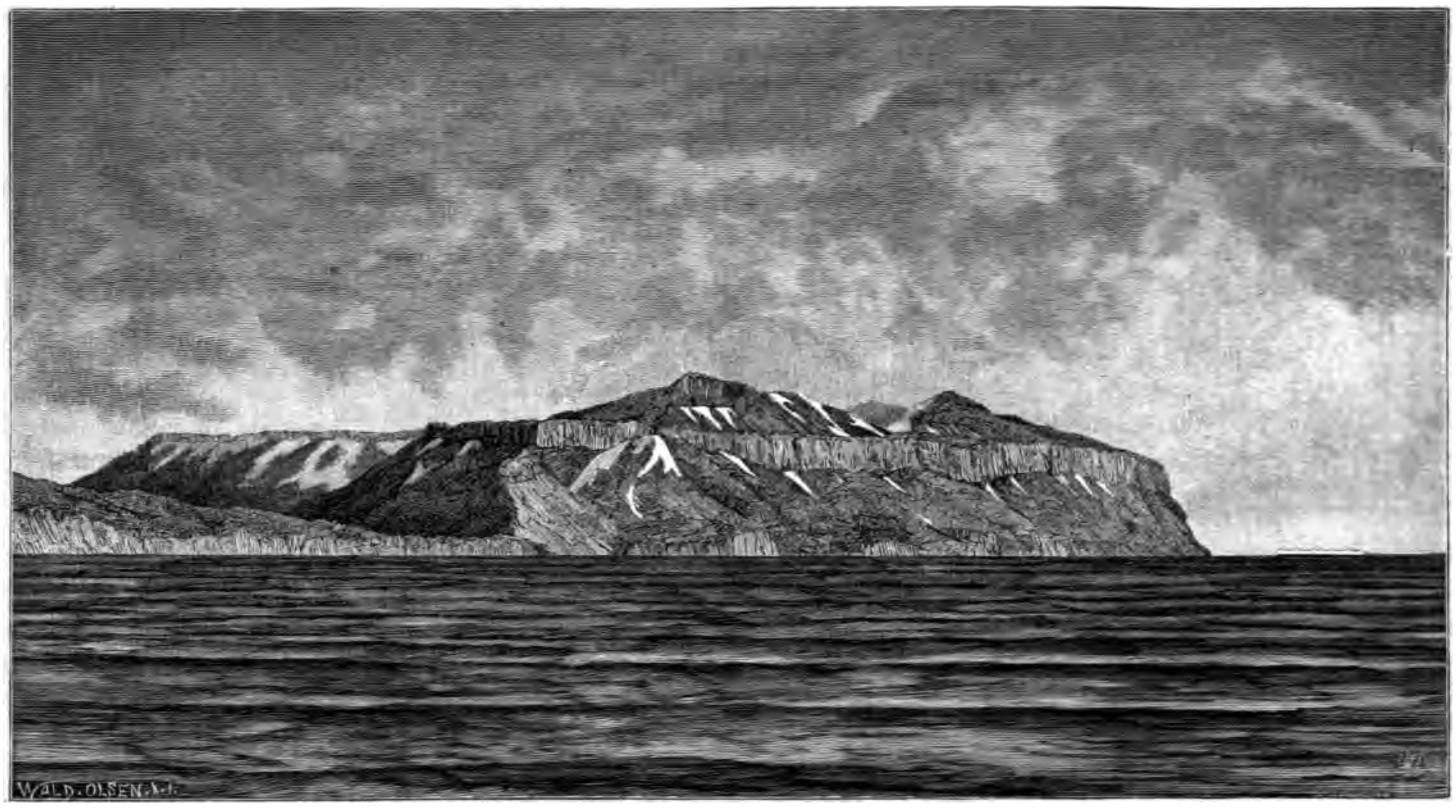


Fig. 8. Mount Misery.

Mount Misery (48° 9′) samt Toppens Højdevinkel over Horizonten (7° 56′, corrigeret for Kimmingdaling). Herefter beregnes Afstanden Stenvarde—Top til 3914 Meter, Afstanden Skib—Top til 3131 Meter, og Højdeforskjellen mellem de to første Punkter til 472 Meter, mellem de to sidste til 541 Meter. Lægges hertil de respective Standpunkters Højde over Havet, 73 Meter og 3 Meter, faaes som Resultat 545 og 544 Meter. Den sidste Bestemmelse har jeg antaget som den sikreste, og sætter saaledes Mount Miserys Højde til 544 Meter eller 1785 engelske Fod. Dette er et større Tal end den paa Søkarterne, formentlig efter et Skjøn, angivne Højde af 1200 Fod.

I marked a point on the mountain, in the vertical plane of the summit, and level with the mound. On returning to the vessel, I measured the angle subtending between the mound and the summit of Mount Misery (48° 9′), as also the angle of elevation of the latter above the horizon (7° 56′, corrected for the dip). The distance between the mound and the summit was then computed, and found to be 3914 metres, that between the ship and the summit 3131 metres, and the difference in altitude between the two first-mentioned points 472 metres, between the two last-mentioned 541 metres. Now, if to these figures be added the height above the sea of the respective standpoints, viz. 73 metres and 3 metres, the result will be 545 and 544 metres. The latter determination I regard as the more trustworthy of the two, and have therefore put the altitude of Mount Misery at 544 metres, or 1785 English feet above the sea-level. This exceeds the height given in the charts — 1200 feet, the result probably of estimation.

i Numerfølge, I, II, III, og indsigtedes ved Øjemaal i Linien. Det blæste en liden Bris tvers paa Linien og Operationen gik let ved at commandere "luf" og "fald". Naar Stængerne flyttedes, satte jeg Foden paa den sidste Stang, indtil den næste var sat til dens Ende og orienteret. Maalingen kunde saaledes paa det flade Terræn blive ret nøjagtig. Grundliniens hele Længde fandtes ved Hjelp af Stængerne og et Metermaal at være 299.11 Meter. Nogen merkelig Reduction for Stængernes Heldning har jeg ikke fundet det praktisk nødvendigt at anbringe. Metermaalet, der anvendtes som Normalmaal, er et i Paris kjøbt, med Regjerings-Stempel forsynet Træmaal til at lægge sammen. Det er henimod en Millimeter længere end et Par andre herværende Meterscalaer af omhyggeligere Construction. Dette Overskud kan regnes at gaa op imod den ved Maalestængernes Heldning og unøjagtige Orientering fremkomne Fejl. Efter Afslutningen af Grundliniemaalingen opsatte jeg Signalerne Y, T og videre vestover.

Den 21de August beregnedes Gaarsdagens Observationer og afsattes i Kartet. Capt. Grieg foretog Lodninger i Advent Bay. Om Eftermiddagen maalte jeg Vinkler fra de Signaler, jeg havde opsat den forrige Eftermiddag.

Den 22de fortsatte Capt. Wille Kartarbejdet. Capt. Grieg loddede om Formiddagen, og Capt. Wille om Eftermiddagen. Kl. 6 Eft. lettede vi og sejlede ud Isfjorden.

Kartet over Advent Bay er tegnet af Capt. Wille. Det originale Kart i 1:30000 er gjengivet her i 1:50000. Kartet beror, som af ovenstaaende Beskrivelse vil sees, paa en fuldstændig Triangulation. De trigonometriske Punkter ere paa Kartet merkede med de latinske Bogstaver. Azimutbestemmelsen, der orienterer Kartet, antages sikker paa et Minut, og Længdeudstrækningerne sikre paa en totusindedel af samme. Angaaende den absolute Bredde og Længde henvises til min Afhandling om de astronomiske Observationer Side 19.

Forresten indeholder Kartet selv de nødvendige Oplysninger.

boatswain and a sailor, so as to extend one after the other (I, II, III) from Base B, and as nearly as the eye could determine in the true line. There was a light breeze blowing at right angles to the base line, and the operation could be easily performed by commanding "luff" and "off." When the rods were being moved, I put my foot on the last of them, keeping it there till the next had been placed end on against it, and properly adjusted. In this manner a pretty accurate measurement could be made on the flat ground. By means of the rods and a metre-measure, the whole length of the base line was found to be 299.11 metres. Any appreciable reduction for the inclination of the rods, I have not thought necessary to apply. The metre-measure, which I used as the standard measure of length, had been bought in Paris; it is of wood, furnished with the government stamp, and made to fold up. This instrument is about a millimetre longer than two other metre-scales, of more accurate construction, that we have here. The excess in length may be regarded as compensating the error arising from the inclination and imperfect adjustment of the rods. After measuring the base line, I erected the signals Y, T, and others farther west.

On the 21st of August, the observations taken the day before were computed and laid down on the Map. Capt. Grieg sounded in the Bay. In the afternoon I measured angles from the signals I had erected on the previous day.

On the 22nd, Capt. Wille went on constructing his map. Capt. Grieg took soundings in the forenoon and Capt. Wille in the afternoon. At 6 p. m. we got under weigh, and steamed out of Ice Sound.

For the Map of Advent Bay we are indebted to Capt. Wille. The original map was on a scale of $\frac{1}{30.000}$; the scale of that annexed to this Memoir is $\frac{1}{50.000}$. As will appear from the above description, the Map of Advent Bay is based on a complete triangulation. The trigonometrical points are denoted by capital letters. The azimuth determination, on which is based the direction of the meridian of the Map, may be regarded as true to a minute, and the longitudinal extent as correct within the two-thousandth part of the actual length. As regards the absolute latitude and longitude, the reader is referred to my "Astronomical Observations," page 19.

For the rest, all necessary information is given in the Map.

Billederne, Fig. 1—9, ere tegnede af Landskabsmaler *Carl Nielsen*, efter Skitser tagne paa Stedet af Hr. F. W. Schiertz, Prof. G. O. Sars og Prof. H. Mohn.

Figs. 1 to 9 are drawn by *Carl Nielsen*, artist, from sketches taken on the spot by F. W. Schiertz, artist to the Expedition, Prof. G. O. Sars, and Prof. H. Mohn.

Translated into English by **John Hazeland.**

..abl. Kjöbenhavn.

FRA VESTMANNA-ÖERNE. ISLAND.

Den 1ste August 1878 laa Expeditionen under Nordostsiden af Beeren Eiland for at have Ly for den paa Havet blæsende Sydvest Storm. Da Vejret om Aftenen syntes at bedage sig, forsøgtes at lande paa Øen. Dette lyktes ogsaa. Vi kom i Land ved Mundingen af Engelsk-Elven, der ved sit Udløb i en liden Bugt danner en Fos. Vi steg op paa Beeren-Eilands flade Plateau, der fandtes at ligge omtrent 34 Meter over Havet, og vandrede en Mils Vej nordover. Kysten er overalt ganske brat, flere Steder helder Fjeldvæggen udover. Den er dannet af horizontale Lag, der som bekjendt tilhøre Stenkulperioden. Fra Søen af ser Kystlinien temmelig ret ud, men fra Land viste den sig at bestaa af fremspringende Nes afvexlende med indgaaende Bugter. Brændingen arbejder uafladelig paa at udgrave de lavere Lag. De overliggende Lag miste sit Underlag, brydes af og styrte i Stranden, hvor de søndermales af Bølgeslaget. Paa Land saa vi, indenfor Plateauets Rand, gabende Sprækker, der havde dannet sig ved de undergravede Lags begyndende Synkning. I Fjæren saa vi, hvorledes Bølgerne tumlede vildt med det nedrasede Lands Rester. Ved enkelte Nes staar igjen Stabber eller Søjler, adskilte fra Landet, ogsaa som Vidnesbyrd om Havets Magt. Disse Stabber, med sine horizontale Lag, frembyde søgte Hækkepladse for talløse Søfugle, der her kunne være i Fred for Fiender. Saaledes skrider Beeren-Eilands Ødelæggelse frem. Den grunde Banke, der strækker sig fra Øst-Spidsbergen til Beeren-Eiland, er sandsynligvis for en stor Del Resterne af dette Land. Nu kommer hertil det faste Materiale, som Drivisen fører med sig og afsætter ved sin Smeltning.

Vort Billede viser denne Kyst med de udoverhængende Lag, de fremstikkende Nes, de af Bølgerne udhulede Bugter, i hvilke Brændingen arbejder, og to af de fritstaaende Stabber.

Inde paa Sletten passerede vi, i en Afstand af et Par Kilometer fra Kysten, en Række smaa grunde Ferskvandsøer, hvis Vand havde en Temperatur af 9° C., og som syntes at være et yndet Opholdssted for talrige Søfugle. Overfladen af Fjeldet bestod af lutter løse Stene, dels som løs Ur, dels som mindre Stene med Jord imellem, der frembød en Smule Vegetation. Hist og her fandtes sammenhængende Mostepper.

4. Spidsbergen.

Den 5te August 1878 fik vi for første Gang Øje paa Spidsbergen. Ved Middag saaes Syd-Spidsbergen forud, et skydækket Land med Sne og Isbræer. Udenfor Sydkap ligge nogle ganske lave Øer. Vi sejlede søndenom disse og

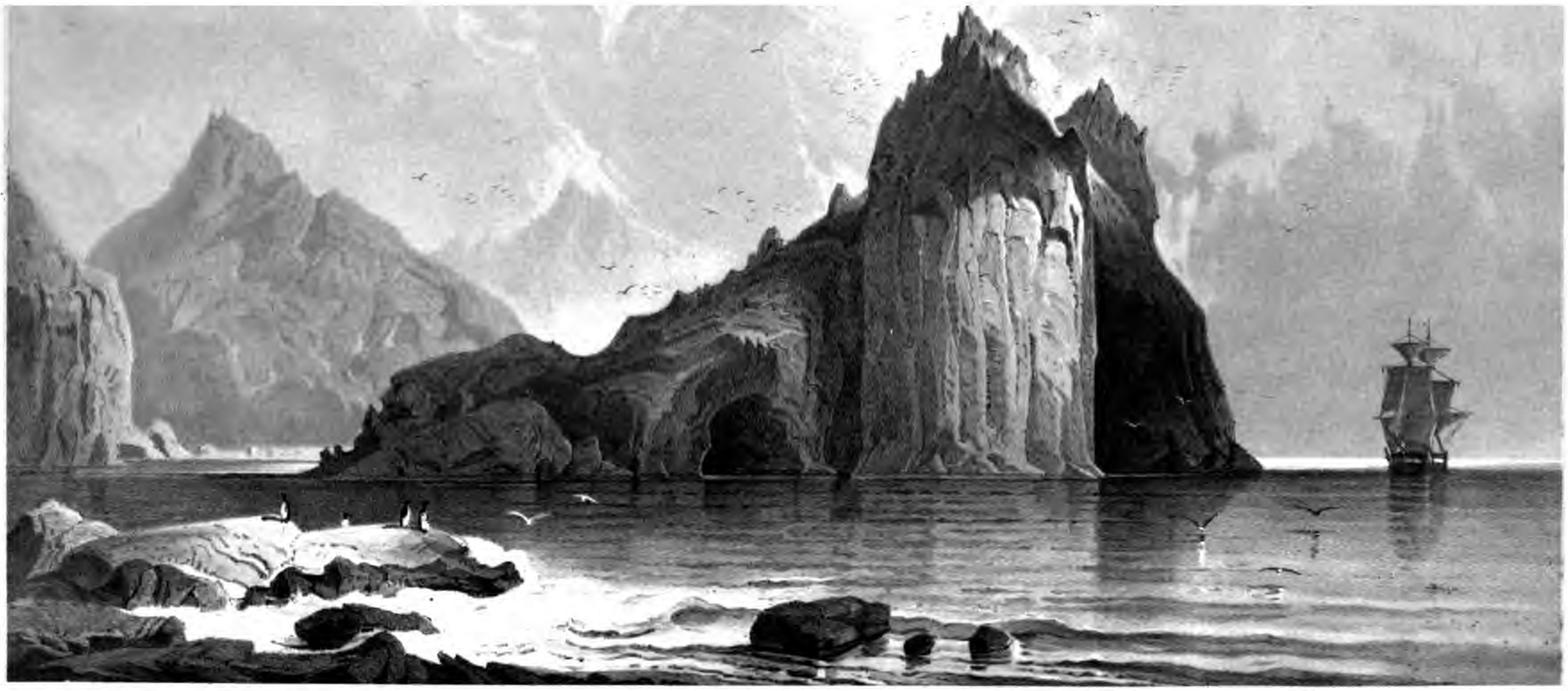
On the 1st of August, 1878, the "Vøringen" rode at anchor off the north-east coast of Beeren Eiland, during a heavy gale from the south-west. In the evening, the weather having somewhat abated, an attempt was made to land on the island. It proved successful. We landed at the mouth of English River, which forms a cataract where it disembogues into a small bay. We ascended to the plateau of Beeren Eiland, that attains an elevation of about 110 feet above the sea, and strolled for a few miles in a northerly direction. The coast is everywhere precipitous, in several places with beetling cliffs. It is built up of horizontal strata belonging to the true carboniferous era. As seen from the sea, the coast appears to extend in a comparatively unbroken line; but on landing, it was found to form numerous headlands and bays. The ceaseless action of the surf gradually wears away the lower strata. The upper layers being thus deprived of their support, give way, and topple down into the sea; where they are broken up by the lashing of the waves. Near the edge of the plateau were seen yawning rents in the surface, showing that the subjacent layers were about to give way. On the beach, we could observe the action of the waves in tossing about the fallen masses. Stumps or columns of rock still remain off some of the headlands, — another proof of the marvellous power of the waves. These columnar rocks afford favourite breeding-haunts for sea-fowl, where they have nothing to fear from their enemies. Thus proceeds the gradual demolition of Beeren Eiland. The bank extending from East Spitzbergen to Beeren Eiland, is probably in greater part the remains of this land, along with the solid matter deposited on the melting of drift-ice.

Our view of this coast shows the beetling stratified cliffs, the bold projecting headlands, the bays and creeks hollowed out by the sea, in which the surf is for ever engaged in its work of destruction, and two of the isolated columnar rocks.

On the plateau, about a mile from the coast, we passed a chain of small freshwater lakes, apparently the favourite resort of innumerable wild-fowl; the temperature of the water was 9° C. The surface of the island consisted exclusively of loose materials, in part dry gravel, in part small stones embedded in earth exhibiting traces of vegetation. Here and there was seen a carpet of moss.

4. Spitzbergen.

On the 5th of August, 1878, we got our first view of Spitzbergen. About noon the "Vøringen" bore down on South Spitzbergen, a cloud-capt land, with snow-fields and glaciers. Off South Cape are seen a number of small,



Tegnet af F. W. Schiertz. Lith. af F. Larsen.

Hoffensberg & Trap's Etabl Kjöbenhavn.

FRA VESTMANNA-ÖERNE. ISLAND.

ligger Taagen over Havet. I Sundet sees et Par Fartøjer tilankers. Det er norske Torskefiskere, der her gjøre et rigt Fiske. Sluppen er den bekjendte "Isbjørn", der i

Fig. 9. Cloven Cliff.

1871 førte Weyprecht og Payer og i 1872 Grev Wilczek paa deres Polarfærder til Spidsbergen og Østhavet.

Om Aftenen den 16de August sejlede Expeditionen ned gjennem Smeerenberg-Sundet, hvor vi saa vort største Isberg, c. 23 Meter højt, staaende paa Grund der hvor South-Gat begynder. Vi passerede South-Gat efter det i 1818 af Beechey og Franklin optagne Kart, og ankrede ved Midnat i Magdalena Bay, indenfor "Begravelsespladsen".

Magdalena Bays storartede Glacialnatur er udmerket

rocky mount that from west to east exhibits a long rent or chasm. In the view, we see how the light falls into this ravine. To the left, rises the island of Vogelsang. Off the islands, a dense fog lies over the sea. In the Sound, one or two vessels are seen riding at anchor. They are Norwegian ships engaged in the Spitzbergen cod-fishery, which hereabouts is very productive. One of the vessels is the "Isbjørn", the well-known cutter that in 1871 took Weyprecht and Payer, and in 1872 Count Wilczek on their exploratory voyages to Spitzbergen and the Barents Sea.

In the evening of the 16th of August, the Expedition steamed through Smeerenberg Sound, and we had a fine view of the largest iceberg seen on any of our cruises. It had grounded in the inner part of South Gat. Its elevation was estimated at about 70 feet. We steered through South Gat by the chart constructed in 1818 by Beechey and Franklin, and cast anchor in Magdalena Bay, within the "burial ground."

The grand glacial scenery of Magdalena Bay is ad-

vel gjengivet i Plancherne til Gaimards Rejse med "la Recherche". Vort Billede, der viser Sydsidens Bræer, er taget fra den fremspringende Landtunge "Begravelsespladsen". I Forgrunden sees, hvorledes det ser ud paa en Campo santo paa Spidsbergen. Til Venstre se vi Landtungen, der forbinder Begravelsespladsen med Land, og udenfor denne den saakaldte Gully's Glacier. Dennes Ende hviler for en stor Del paa Fjæren, langs hvilken jeg passerede foran den, men i Midten gaar Bræen ud i Havet og her løsner stadig Stykker af den. Jeg blev Vidne til et saadant Skuespil. En høj Issøjle løste sig med et Brag fra Bræens yderste Væg. Den heldede udover og begyndte sit Fald med en svingende Bevægelse, støttet paa sin underste Ende. Jeg ventede at se den falde med hele sin Sideflade i Vandet, men dette skede ikke. Da den havde svunget udad en 30 Grader fra Verticalen, sank hele Issøjlen med Et sammen med en gjennemgaaende Verticalbevægelse, knustes og strøedes som mindre Stykker over Søen, der ved Faldet sattes i sterk Bølgegang. — Jeg var oppe paa Bræen paa dens Nordside; den var uden større Sprækker og havde en meget jevn Overflade.

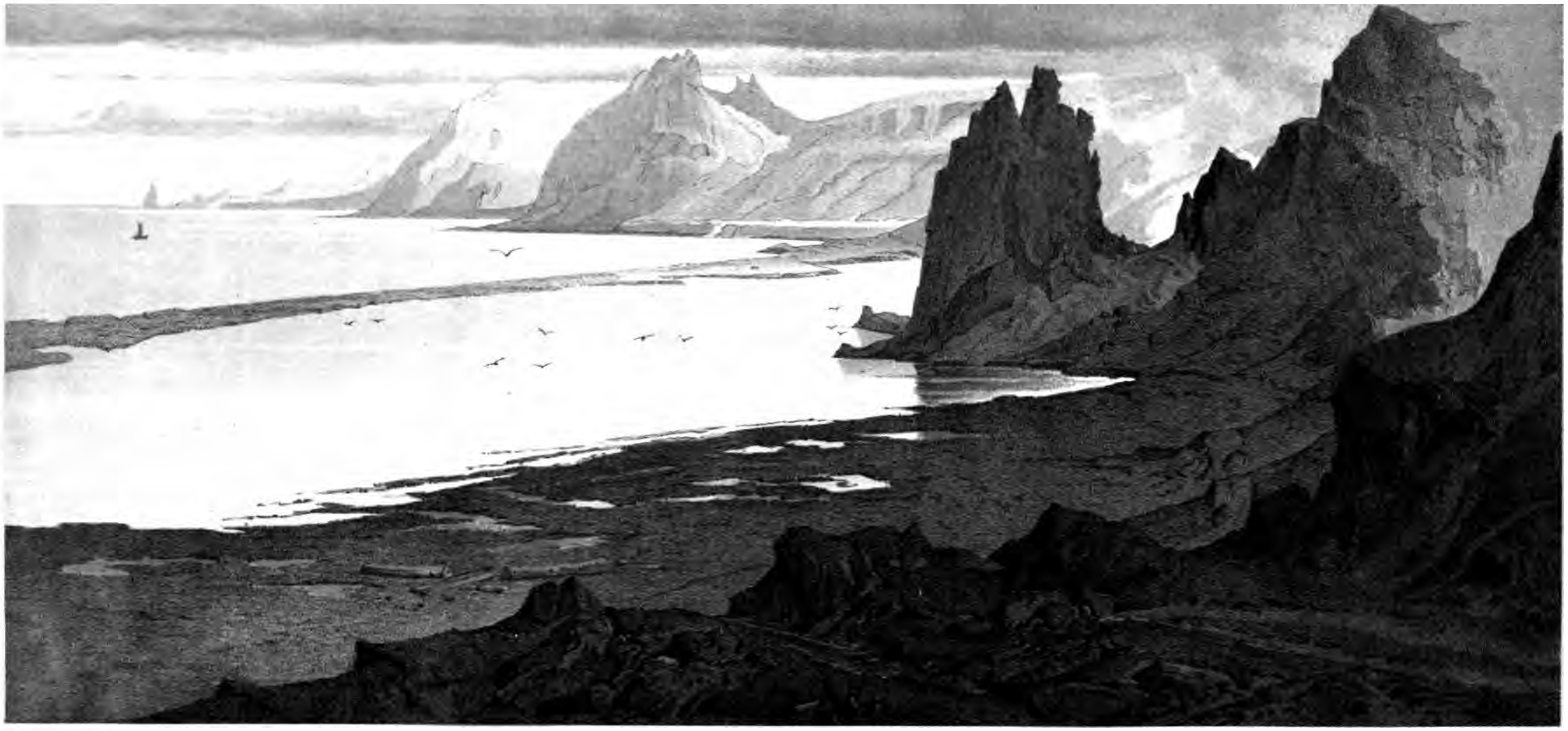
I det indre Basin af Magdalena Bay gjenfandt jeg de af Charles Martins i 1839 maalte lave Dybtemperaturer. Bundtemperaturen var her — 2.°1, den laveste Temperatur i Havet, jeg havde fundet paa hele vor Expedition. Og her var et rigt arctiskt Dyreliv.

Fra den 19de til den 22de August laa Expeditionen tilankers i Advent Bay, Isfjorden, Spidsbergen, medens Maskinen eftersaaes. Denne Anledning benyttede Capt. Wille til at optage et nøiagtigt Kart over Advent Bay, der ofte besøges af norske Fangstfartøjer. Eftermiddagen den 19de benyttedes til en Recognoscering, og der opsattes nogle Signaler. Den 20de om Morgenen tog jeg paa Odden (Basis A) en Række Solhøjder. (Se H. Mohn. Astronomiske Observationer Side 19). En Grundlinie blev udstukket og merket med Teltpinde paa det flade og jevne Terræn langs Stranden. Grundlinien er i Kartet optrukket mellem Punkterne A og B. Horizontalvinklerne til de nærmeste Signaler maaltes med Theodolit. Ved Middagstid bestemtes Azimut af Linien A C med Theodolit og Solen af Capt. Wille og mig i Forening. Derpaa fik jeg atter nogle Solhøjder. Om Eftermiddagen rejste Capt. Wille med Baad rundt den indre Del af Bugten og maalte med Sextant Horizontalvinklerne mellem de opsatte Signaler. Samtidig hermed maalte jeg Grundliniens Længde. Jeg benyttede hertil 3 Træstænger, af tilsammen 9.112 Meters Længde, ret afskaarne for Enderne. Disse lagdes af mine Assistenter, Baadsmanden og en Matros, fra Basis B af paa Jorden,

mirably rendered in the Plates annexed to Gaimard's voyage with "la Recherche." Our view of the glaciers of the south-coast is taken from the tongue of land termed "the burial ground." In the foreground, we have the aspect of a Campo Santo on Spitzbergen. To the left stretches the isthmus connecting the burial-ground with the main land, and off the former rises the so-called Gully's Glacier. The terminal portion of this glacier rests in greater part on the beach, along which I strolled below it; but the middle section projects into the sea, and here large fragments are continually breaking off. I was myself a witness of this gradual dismemberment. A lofty column of ice parted with a loud crash from the outer wall of the glacier. Supported at its lower end, the fall commenced with a slow, swaying movement. I expected to see it strike the water with the whole of its lateral surface, but in this was mistaken; having swung some 30 degrees out of the perpendicular, the entire column suddenly collapsed, taking a well-nigh vertical direction, and was smashed to pieces, the fragments being scattered over the sea, which became violently agitated by the shock. I had ascended the glacier from the north side; its surface was remarkably even and exhibited no considerable fissures.

In the inner basin of Magdalena Bay I observed the low deep-sea temperatures found by Charles Martins in 1839. The bottom-temperature was — 2.°1 C., the lowest temperature I at any time observed in the water of the sea on the cruises of the Expedition. And yet these depths disclosed an abundance of animal life.

From the 19th to the 22nd of August, the "Vøringen" lay at anchor in Advent Bay, Ice Sound, Spitzbergen, her engines having to be cleaned and examined. Capt. Wille took advantage of this opportunity to construct a map of Advent Bay, a locality which is frequently visited by Norwegian fishing vessels. The afternoon of the 19th was devoted to reconnoitring in the vicinity of the Bay, and a few signals were erected. On the morning of the 20th, I took from the tongue of land (Base A) a series of solar altitudes (See H. Mohn. Astronomical Observations, p. 19). A base line was marked out with tent-pegs along the flat, beachy strand. On the Map, the base line extends between the points A and B. About noon, Capt. Wille and myself determined with the theodolite the azimuth of the line A C by the sun. I then succeeded in taking another series of solar altitudes. In the afternoon, Capt. Wille rowed round the inner shore of the Bay, and measured with the sextant the horizontal angles between the signals. Whilst he was thus engaged, I measured the length of the base line. For this purpose, I made use of three wooden rods, cut straight off at the ends, measuring together 9.112 metres. These rods were placed on the ground by my two assistants, the

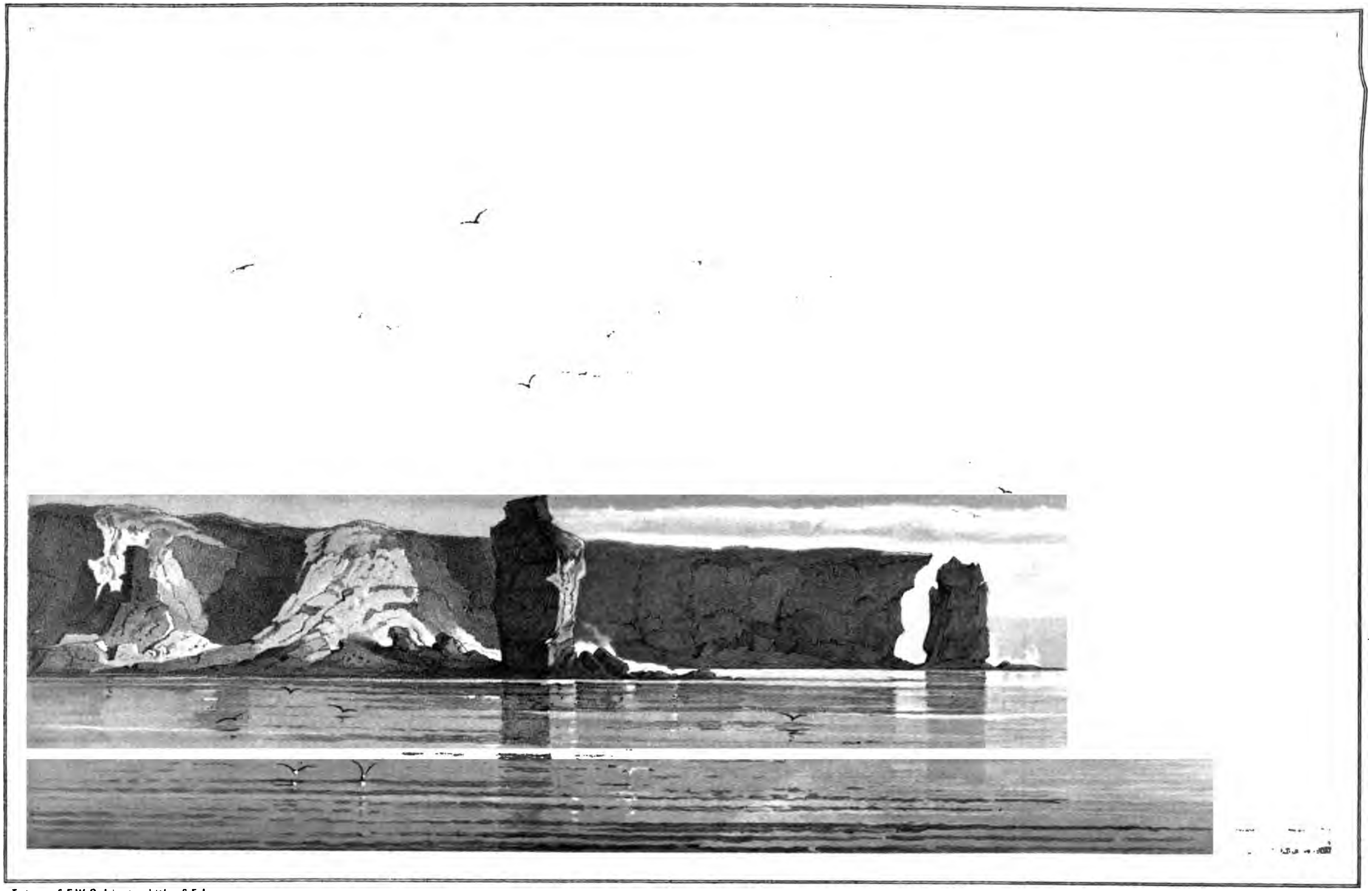


Tegnet af F.W. Schiertz. Lith. af F. Larsen. Hoffensberg & Trap's Etabl. Kjøbenhavn.

LAGUNEN PAA ÖSTSIDEN AF JAN MAYEN.

BEERENBERG. JAN MAYEN.

BEERENBERG. JAN MAYEN.



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ÖSTSIDEN AF BEEREN-EILAND.

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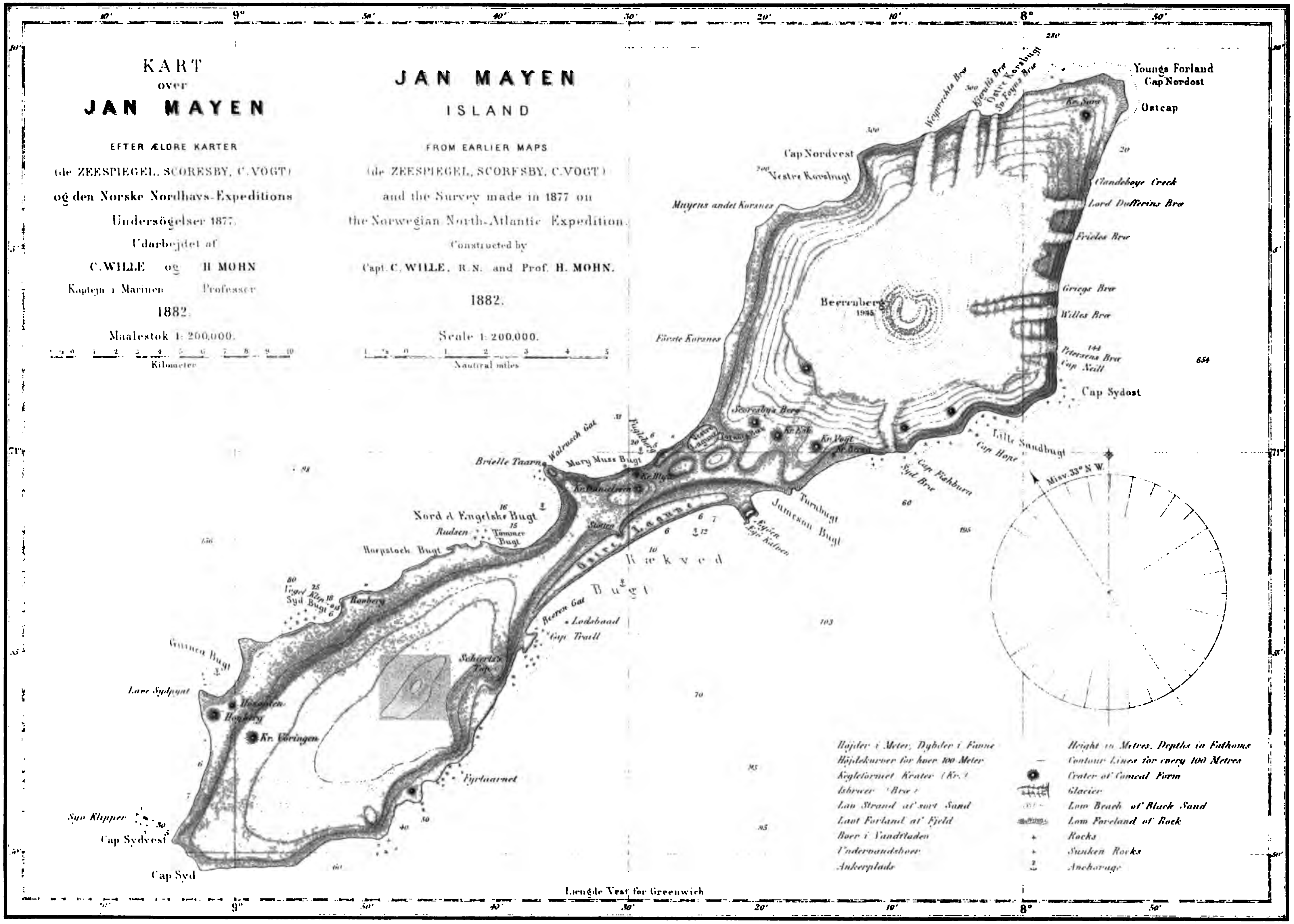
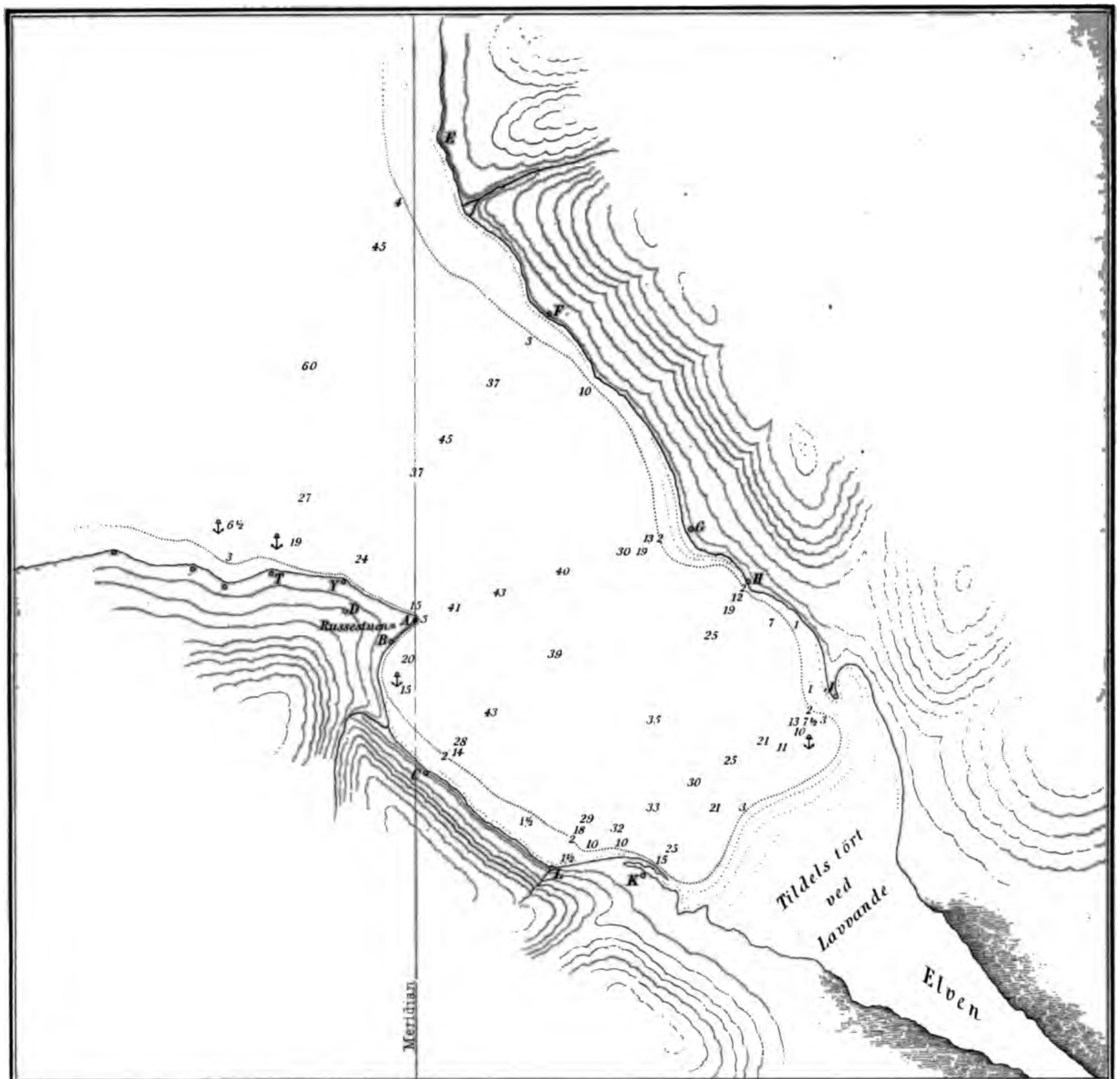
SYDKAP. SPIDSBERGEN.


KART
over
JAN MAYEN
EFTER ÆLDRE KARTER
(de ZEESPIEGEL, SCORESBY, C.VOGT)
og den Norske Nordhavs-Expeditions
Undersögelser 1877.
Udarbejdet af
C.WILLE og H MOHN
Kaptejn i Marinen Professor
1882.
Maalestok 1: 200,000.
Kilometer
JAN MAYEN
ISLAND
FROM EARLIER MAPS
(de ZEESPIEGEL, SCORESBY, C.VOGT)
and the Survey made in 1877 on
the Norwegian North-Atlantic Expedition.
Constructed by
Capt. C. WILLE, R.N. and Prof. H. MOHN.
1882.
Scale 1: 200,000.
Nautical miles
Youngs Forland
Cap Nordost
Ostcap
Cap Nordvest
Beerenberg
1945
Cap Sydost
Clandeboye Creek
Lord Dufferins Bræ
Friele's Bræ
Griegs Bræ
Willes Bræ
Petersens Bræ
Cap Neill
Lille Sandbugt
Cap Hope
Cap Fishburn
Misv. 33° N.W.
Mary Muss Bugt
Brielle Taarn
Walrusch Gat
Nord el. Engelske Bugt
Rudsen
Tömmer Bugt
Horpstock Bugt
Syd Bugt
Guinea Bugt
Lave Sydpynt
Kr. Vöringen
Schierta's Top
Jameson Bugt
Turnbugt
Östre Lagune
Rækved Bugt
Beeren Gat
Lodsbaad
Cap Traill
Fyrtaarnet
Syv Klipper
Cap Sydvest
Cap Syd
Længde Vest for Greenwich
Højder i Meter; Dybder i Favne
Höjdekurver for hver 100 Meter
Kegleformet Krater (Kr.)
Isbræer (Bræ)
Lav Strand af sort Sand
Lavt Forland af Fjeld
Boer i Vandfladen
Undervandsboer
Ankerplads
Height in Metres, Depths in Fathoms
Contour Lines for every 100 Metres
Crater of Conical Form
Glacier
Low Beach of Black Sand
Low Foreland of Rock
Rocks
Sunken Rocks
Anchorage
Den private Opmaalings lith. Anstalt Kristiania



KART over ADVENT BAY

i Isfjorden paa Spidsbergen.

optaget af Kaptejn i Marinen C. F. Wille

med Assistance af

Professor Dr. H. Mohn og Skibskaptein J. Grieg. 1878.

Punkt A ligger paa { *78° 14′ 48″ Nord Bredde* / *15° 34′ 14″ Længde Öst Gr.* }

Azimuth af Linien A C er 3° 15′,5 S. ad Ö.

Kompassets Misvisning 1878-12°,25 vestlig

Lodskud i Favne.

ADVENT BAY

Spitzbergen; Icefjord.

Surveyed by Capt. C. F. Wille R. N

with the assistance of

Prof. H. Mohn and Capt. J. Grieg. 1878

Point A { *78° 14′ 48″ Nth Lat.* / *15° 34′ 14″ Long. E. Gr.* }

Azimuth of line A C = S 3° 15′,5 E.

Variation in 1878 = 12°,25 West.

Soundings in fathoms.

Maalestok 1: 50,000.

0 5 10 Kabl.

0 1 2 3 4 Kvartmil (Naut miles)

THE NORWEGIAN NORTH-ATLANTIC EXPEDITION

1876—1878.

V.

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1. ASTRONOMICAL OBSERVATIONS.

H. MOHN.

2. MAGNETICAL OBSERVATIONS.

C. WILLE.

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WITH 6 CHROMO-LITHOGRAPHS, 13 WOOD ENGRAVINGS AND 2 MAPS.

H. MOHN.

CHRISTIANIA.
PRINTED BY GRONDAHL & SON.
1882.

LEIPZIG. K. F. KÖHLER.

LONDON, SAMPSON, LOW, MARSTON, SEARLE & RIVINGTON.

PARIS. K. NILSON.